INSTRUCTION BOOK

ARC Type 21

AUTOMATIC DIRECTION FINDER

(CAATC No. 1R4-9)

Aircraft Radio Corporation

BOONTON, NEW JERSEY, U.S.A.

Preliminary

INSTRUCTION BOOK

for

ARC TYPE 21
AUTOMATIC DIRECTION FINDER

Aircraft Radio Corporation

BOONTON, NEW JERSEY

ARCIB-21-3

August 1956

A — 40V 100~ ØL ± 90 —

B — LV +

C — GND

D — PWR RELAY

E — 100~ ØL 0°

F — 100~ plate

G — 100~ plate

H — 100~ ØL 180°

I — LV + SOURCE

J — HV 1

K — HV 2

L —

A
E
F
G
H

DONE

Pwr supply wires to be shielded
ARC ADF

A — LV +

B — +125 HV

C — 110V HV2

D — COMP ANT

E — AF GRID

F — BAND 1

G — " 2

H — " 3

I — 100~ 13V

J — TEL

K — SENSE

L

M — PLATE

N — PLATE

O — AF PLATE

P

Q — TEST

ARC
ADF
MOD
PUT
SHIELDED
WIRES
IN ON
WIRES
MARKED

NOT DONE

ARC ADF WIRES TO BE SHIELDED

TABLE OF CONTENTS

Paragraph *Page*

SECTION I – GENERAL INFORMATION

1–1. Purpose 1
1–3. Equipment Supplied 1
1–5. Equipment Required But Not Supplied 2
1–7. Characteristics 2
1–9. Description of Components 3

SECTION II – THEORY OF OPERATION

2–1. General 5
2–4. Receiver Type R-30 5
2–21. Loop Type L-11 7
2–23. Control Unit Type C-59 7
2–27. Power Unit Type P-14 8
2–30. Indicators Type IN-12 and IN-13 8

SECTION III – INSTALLATION AND ADJUSTMENT

3–1. Installation Considerations 9
3–3. Installation of Receiver Type R-30 and Mounting Type M-26 11
3–5. Installation of Control Unit Type C-59 12
3–7. Installation of Indicator Type IN-12 or Indicator Type IN-13 12
3–9. Installation of Power Unit Type P-14 and Mounting Type M-28 12
3–11. Installation of Sense Antenna Feed-Through Insulator ARC-19077 12
3–13. Installation of Sense Antenna 15
3–15. Installation of Loop Type L-11 15
3–17. Installation of Housing Kit ARC-19050 for Loop Type L-11 15
3–22. Installation of Mechanical Linkage 18
3–24. Loop Compensation Procedures 19
3–25. General 19
3–26. Compensation of Loop on Ground 19
3–27. Obtaining Flight Data for Loop Compensation 20
3–28. Obtaining Flight Data for Loop Compensation, Method 1 20
3–29. Obtaining Flight Data for Loop Compensation, Method 2 20
3–33. Compensation Data Curve 25
3–34. Adjustment of Loop Compensation Screws 25

SECTION IV – OPERATION

4–1. Operating Controls 28
4–3. Operation of ARC Type 21 ADF, General Procedure 28
4–4. ADF Homing Operation 29
4–10. ADF Magnetic Bearing Determination 29
4–12. ADF True Bearing Determination 29
4–14. Position Determination 29
4–15. Operation of ARC Type 21 as a Low-Frequency Range Receiver 29

TABLE OF CONTENTS — Continued

Paragraph *Page*

SECTION V — MAINTENANCE

5–1. General 30
5–4. Replacement of Tubes 30
5–6. Removal and Replacement of R-F Assemblies 30
5–11. Maintenance of Power Unit Type P-14 35
5–16. Circuit Alignment Procedure 36
5–23. Receiver Measurements 37

SECTION VI — DRAWINGS

LIST OF ILLUSTRATIONS

Figure *Title* *Page*

SECTION I — GENERAL INFORMATION

1–1. ARC Type 21 Automatic Direction Finder, Major Components iv

SECTION II — THEORY OF OPERATION

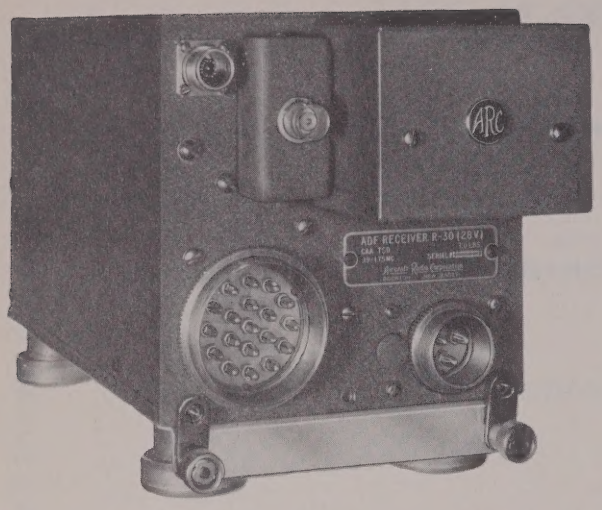
2–1. Block Diagram of ARC Type 21 ADF 5

SECTION III — INSTALLATION AND ADJUSTMENT

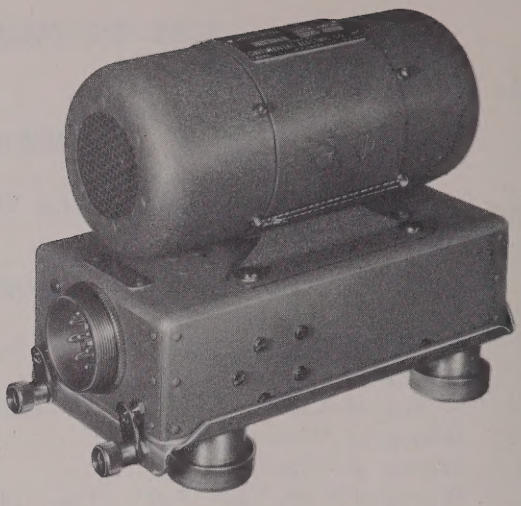
3–1. Receiver Type R-30, Outline Dimensions 10
3–2. Mounting Type M-26, Outline Dimensions 11
3–3. Control Unit Type C-59, Outline Dimensions 12
3–4. Indicator Type IN-12, Outline Dimensions 13
3–5. Indicator Type IN-13, Outline Dimensions 13
3–6. Power Unit Type P-14, Outline Dimensions 14
3–7. Mounting Type M-28, Outline Dimensions 15
3–8. Loop Type L-11, Outline Dimensions 16
3–9. Installation of Housing ARC-17764 for Fitting to Mounting Surface 17
3–10. Location of Mounting Brackets for Housing ARC-17764 18
3–11. Location of Mounting Holes on Housing ARC-17764 18
3–12. Procedure for Obtaining Flight Data for Loop Compensation, Flying Ground Reference Line 21
3–13. Form for Recording Flight Data for Loop Compensation 22
3–14. Example of Recorded Flight Data for Loop Compensation 23
3–15. Procedure for Obtaining Flight Data for Loop Compensation, Flying Two 360-Degree Turns 24
3–16. Form for Plotting Loop Compensation Data Curve 26
3–17. Example of Loop Compensation Data Curve 27

LIST OF ILLUSTRATIONS — Continued

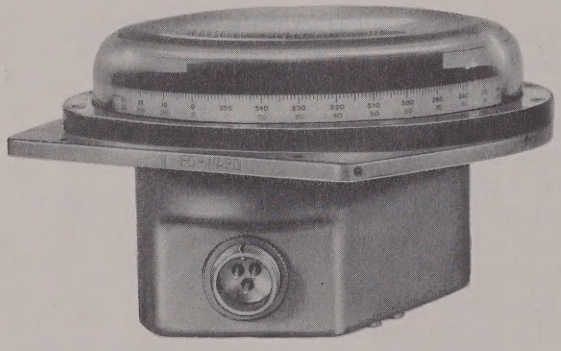
Figure	*Title*	*Page*
	SECTION IV — OPERATION	
4–1.	Control Unit Type C-59, Front Panel View	28
	SECTION V — MAINTENANCE	
5–1.	Location of Electron Tubes in Receiver Type R-30	31
5–2.	Wiring of V101	32
5–3.	Wiring of V102	32
5–4.	Wiring of V103	33
5–5.	Wiring of V104	33
5–6.	Wiring of V105, V106, V107, V108, V109, and V110	34
5–7.	Wiring of V111, V112, V113, and V114	35
5–8.	Bench Test Set-up for Alignment of Receiver Type R-30	37
5–9.	Alignment Adjustments for Receiver Type R-30	38
	SECTION VI — DRAWINGS	
6–1.	Receiver Type R-30, Schematic Diagram	45/46
6–2.	Receiver Type R-30, Wiring Diagram	47/48
6–3.	Receiver Type R-30 Loop Unit, Wiring Diagram	49/50
6–4.	Receiver Type R-30 Modulator Unit, Wiring Diagram	51/52
6–5.	Receiver Type R-30 Antenna Unit, Wiring Diagram	53/54
6–6.	Receiver Type R-30, First R-F Unit, Wiring Diagram	55/56
6–7.	Receiver Type R-30, Second R-F Unit, Wiring Diagram	57/58
6–8.	Receiver Type R-30, Oscillator Unit, Wiring Diagram	59/60
6–9.	Receiver Type R-30, Band Selector, Wiring Diagram	61
6–10.	Control Unit Type C-59, Schematic Diagram	62
6–11.	Control Unit Type C-59, Wiring Diagram	63/64
6–12.	Loop Type L-11, Schematic Diagram	65/66
6–13.	Loop Type L-11, Wiring Diagram	67/68
6–14.	Power Unit Type P-14, Schematic Diagram	69/70
6–15.	Power Unit Type P-14, Wiring Diagram	71/72
6–16.	ARC Type 21 ADF, Single ADF Installation, External Connection Diagram	73/74
6–17.	ARC Type 21 ADF, Single ADF Installation, Cabling Diagram	75/76
6–18.	ARC Type 21 ADF, Dual ADF Installation, External Connection Diagram	77/78
6–19.	ARC Type 21 ADF, Dual ADF Installation, Cabling Diagram	79/80
6–20.	Panel Mounting Dimensions for Installation of Dial Gearing Unit and Mask in Custom Control Panel	81/82
6–21.	Panel Mounting Dimensions for Installation of Tuning Meter in Custom Control Panel	83/84
6–22.	Sample Form for Compensation Data Curve (Spare)	85



RECEIVER TYPE R-30
WITH
MOUNTING TYPE M-26

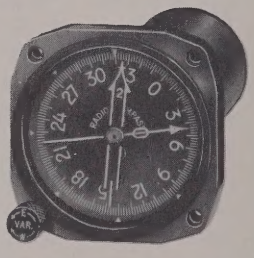


POWER UNIT TYPE P-14
WITH
MOUNTING TYPE M-28

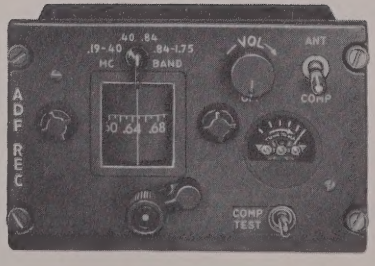


LOOP TYPE L-11

INDICATOR TYPE IN-12



INDICATOR TYPE IN-13



CONTROL UNIT TYPE C-59

Figure 1—1. ARC Type 21 Automatic Direction Finder, Major Components

SECTION I

GENERAL INFORMATION

1–1. PURPOSE.

1–2. The ARC Type 21 Automatic Direction Finder is a light-weight, airborne radio compass system designed to provide automatically a visual bearing indication of the direction from which an incoming r-f signal is being received, and for the aural reception of amplitude-modulated signals, such as four-course radio ranges. The ARC Type 21 ADF operates within a frequency range of 190 to 1750 kilocycles, divided into three bands as follows: 190 to 400 kc, 400 to 840 kc, and 840 to 1750 kc.

1–3. EQUIPMENT SUPPLIED.

1–4. The components and accessories which comprise the ARC Type 21 ADF are listed in table 1–1. The major components are shown in figure 1–1. Table 1–1 lists the quantity and type of components and accessories required for either a single or a dual installation of the ARC Type 21 ADF. Also included in table 1–1 are the over-all dimensions and weights.

TABLE 1–1. EQUIPMENT SUPPLIED

Quantity Per Installation		ARC Nomenclature	ARC Part No.	Over-all Dimensions (Inches)			Weight (lb)
Single	Dual			Height	Width	Depth	
		MAJOR COMPONENTS					
1	2	Receiver Type R-30 *	17960	4-1/2	4-9/16	10-5/32	6.5
1	2	Loop Type L-11	18000	4	6-9/16	6-9/16	4.3
1	2	Control Unit Type C-59 *	17980	3-3/4	5-3/4	3-3/4	1.6
1	–	Indicator Type IN-12	17990	3-1/4	3-1/4	3-9/16	1.3
		or					
–	1	Indicator Type IN-13	17730	3-1/4	3-1/4	5-5/8	1.8
1	2	Power Unit Type P-14 *	18020	4-15/16	3-3/8	7-7/32	5.0
1	2	Mounting Type M-28	18350	1-11/32	3-11/16	7-3/16	0.4
1	2	Mounting Type M-26	18010	1-7/16	4-11/16	9-3/32	0.5
		ACCESSORIES					
1	2	Loop Housing Kit †	19050	2	6-3/4	18	0.5
1	2	Antenna Cable Assembly	17984 ‡	–	–	–	0.3
		or					
1	2	Antenna Cable Assembly	18637 ‡	–	–	–	1.2
1	2	Loop Cable Assembly	17985	–	–	–	0.4
1	2	Insulator Assembly §	19077	–	–	–	0.03
1	2	Sense Antenna Kit §	19210	–	–	–	0.4

* The R-30, C-59, and P-14 are supplied in either a 14-volt or 28-volt model.

† The dimensions and weight given are for Housing ARC-17764, which is part of the kit.

‡ Antenna Cable Assembly ARC-17984, which is 7 feet long, and Antenna Cable Assembly ARC-18637, which is 14 feet long, are alternative components. Refer to paragraph 1—23 for further details.

§ Sense Antenna Kit ARC-19210 and Insulator Assembly ARC-19077 are optional. Sense Antenna Kit ARC-19210 includes Insulator Assembly ARC-19077. If a sense antenna other than ARC-19210 is installed, Insulator Assembly ARC-19077 is required for proper installation.

TABLE 1–1. EQUIPMENT SUPPLIED — Continued

Quantity Per Installation		ARC Nomenclature	ARC Part No.	Over-all Dimensions (Inches)			Weight (lb)
Single	Dual			Height	Width	Depth	
		ACCESSORIES — Continued					
–	1	Connector, plug	16210	–	–	–	0.07
2	4	Connector, plug	16115	–	–	–	0.14
1	–	Connector, plug	14491	–	–	–	0.04
1	2	Connector, plug	16742	–	–	–	0.12
1	2	Connector, plug	19062	–	–	–	0.06
		PUBLICATIONS					
1	2	Instruction Book for ARC Type 21 ADF	–	–	–	–	–

1–5. EQUIPMENT REQUIRED BUT NOT SUPPLIED.

1–6. To complete the installation of the ARC Type 21 ADF, the following equipment is required:

A primary power source capable of supplying 2.8 amperes at 27.5 volts dc, or 5.6 amperes at 13.7 volts dc, depending on the voltage rating of the equipment.

A non-directional sense antenna, if Sense Antenna Kit ARC-19210 is not included as part of the supplied ARC Type 21 ADF equipment. The sense antenna should have a capacitance of as near 50 μμf as possible.

A feed-through insulator assembly for the sense antenna downlead, unless Insulator Assembly ARC-19077 is supplied. This feed-through insulator should be of reasonably low capacitance, water-tight, and light in weight.

A suitable length of Mechanical Linkage ARC-16158 for remote-control tuning of the R-30 by the C-59.

A headset, or other means of aural reception.

A connection from pin J of the C-59 connector to the aircraft's panel-lamp rheostat to control the brilliancy of the panel lamps in the C-59.

1–7. CHARACTERISTICS.

1–8. The following is a summary listing of the electrical characteristics of the ARC Type 21 ADF. Individual weights and dimensions are included in table 1–1.

FREQUENCY RANGE: 190 to 1750 kilocycles.

PRIMARY POWER REQUIREMENTS: 2.8 amperes at 27.5 volts dc, 5.6 amperes at 13.7 volts dc, depending on the voltage rating of the equipment. (All required high-voltage ac and dc potentials are supplied by the dynamotor-alternator of the P-14; the input power requirements of the P-14 are included in the over-all requirements stated.)

RECEIVER TYPE R-30:

Frequency Range: 190 to 1750 kc.

Tuning Bands: 190 to 400 kc; 400 to 840 kc; 840 to 1750 kc.

Band Switching: Electrical.

Tuning: Remote-controlled by Control Unit Type C-59 with interconnecting Mechanical Linkage ARC-16158 (not supplied, but available from qualified installation agencies).

Sensitivity:

Antenna: 4 to 10 μv in series with 50 μμf capacitance through standard input cable of 100 μμf for 6.0 db S + N/N output ratio.

Loop: 10 to 25 microvolts/meter for a maximum of 2 degrees error, and ±2 degrees jitter.

Image Rejection: At 190 kc, greater than 110 db; at 379 kc, greater than 100 db; at 1750 kc, greater than 70 db.

I-F Rejection: At 190 kc, greater than 85 db; at 1750 kc, greater than 100 db.

Bandwidth (kc off resonance, modulated 30 percent at 1000 cps): At 6 db, 1.6 to 2.8 kc (depending on frequency from 190 to 1750 kc); at 60 db, 4.2 to 8.5 kc (depending on frequency from 190 to 1750 kc).

A-F Power Output: 300 mw into 300 ohms.

Intermediate Frequency: 142.5 kc.

POWER UNIT TYPE P-14:

Dynamotor-Alternator Input: 26.5 volts dc, 2.2 amperes; or 13 volts dc, 4.4 amperes. (Input voltage depends on whether 14- or 28-volt model is used.)

Dynamotor-Alternator Outputs: 125 volts dc, 100 milliamperes; and 13 volts ac, 800 milliamperes, 100 cps ±3 cps.

1–9. DESCRIPTION OF COMPONENTS.

1–10. RECEIVER TYPE R-30. Receiver Type R-30 is a superheterodyne receiver covering a frequency range of 190 to 1750 kc in three bands. Fourteen subminiature "premium" type electron tubes are used. Each tube is soldered directly into the circuit without the use of tube sockets. All tubes can be replaced without removing any other parts. Silver alloy tube clamps are used to conduct the bulb heat of each tube to the chassis. The three frequency bands are selected by remote control of a band-switching d-c motor through a 4000:1 speed reduction gear train. Remote tuning of the receiver is accomplished through flexible mechanical linkage which interconnects the receiver and Control Unit Type C-59. To facilitate maintenance, the receiver consists of wired-in subassemblies, which are pretested prior to final assembly; also, the i-f/a-f section is constructed on a hinged chassis which can be folded down to expose the circuitry. The tuning capacitor is a five-section-ganged variable capacitor constructed of brass longitudinal members and stator plates. The rotor plates are made of Invar to produce a reduction in capacitance with a temperature increase. This compensates for the increase in inductance brought about by a temperature rise. Fixed compensating capacitors are also used. As a result of these compensating circuits, there is a negligible change in sensitivity and selectivity over the range of −55°C (−67°F) to +71°C (+159.8°F).

1–11. A total of fifteen r-f transformers are used, five for each frequency band. Each r-f section contains the three r-f transformers, the associated switch-wafer section, and, if required, an electron tube. The r-f transformers are of cup-core construction, using a relatively high permeability iron. All are preset in inductance, filled with nitrogen, and hermetically sealed to lock out moisture. The i-f amplifier consists of three double-tuned transformers which are preset, filled with nitrogen, and hermetically sealed, for maximum reliability under adverse conditions of humidity and temperature.

1–12. The 28-volt model of the R-30 operates from a nominal-value primary power source of 2.8 amperes at 27.5 volts dc. The 14-volt model requires 5.6 amperes at 13.7 volts dc. A-c and high-voltage d-c potentials are supplied by Power Unit Type P-14. All electrical and mechanical connections are made through receptacles located on the front panel. The R-30 requires Mounting ARC Type M-26 for installation.

1–13. LOOP TYPE L-11. Loop Type L-11 is a hermetically sealed assembly which, in addition to the loop antenna, incorporates a drive motor, a synchro transmitter, and an adjustable compensating mechanism. The compensating mechanism corrects for bearing errors caused by the airplane's structure. It consists of a horizontal circular track, which is adjustable in elevation by 14 screws, and on which a roller rides. The screws are spaced around the track at 30-degree intervals, except in the forward and aft 30-degree sectors, where they are spaced 15 degrees apart. The adjustment, around the circle, of track elevation varies the position of a gear on the loop shaft, relative to a driving gear feeding the synchro transmitter, in such a way as to correct for the error pattern of the particular airplane.

1–14. The loop antenna is a coil of several widely spaced turns of wire wound on a flat ferrite core. The ferite core, because of its high permeability, concentrates the r-f field in the loop coil. As a result, the sensitivity of the ferrite loop is equal to that of air-core loops that are many times larger. The loop antenna is driven by a miniature two-phase induction motor; its relative bearing is synchro-transmitted to Indicator Type IN-12 or Indicator Type IN-13, located in the cockpit.

1–15. The loop antenna is covered with a glass dome and hermetically sealed. Connectors are of the glass-to-metal seal type. The antenna terminals are fed to the connector through three coaxial slip rings, made of etched, copper-clad phenolic and plated with nickel and rhodium. The wiping contacts are of gold alloy. The use of such materials provides long life with low noise over extreme temperatures. In order to maintain low friction losses, all shafts in the loop and associated gear trains run on precision ball bearings.

1–16. The loop transmission cable assembly is part of the tuned loop circuit. It is approximately 20 feet long and has a capacitance of 350 μμf. It is a 5/32-inch diameter, three-conductor, shielded cable.

1–17. CONTROL UNIT TYPE C-59. Control Unit Type C-59 is an edge-lighted plastic panel, console-type control assembly for the ARC Type 21 ADF. It includes a function selector switch, band selector switch, tuning crank, volume control, tuning meter, and compass-test switch. The frequency dial is displayed on a drum to provide an equal dial length for each of the three bands. The band switch actuates a masking drum which surrounds the frequency dial drum and allows only the selected band to be visible. The band switch also controls the operation of a small d-c motor on the front of Receiver Type R-30. This motor is geared through a 4000:1 reduction ratio to a six-gang wafer switch in the r-f section of the receiver. The ANT-COMP switch, when set to the ANT position, permits the receiver to be used for the reception of radio ranges. Under this condition, loop and modulating circuits of the R-30 are de-energized, and the C-59 volume control becomes an r-f sensitivity control that effectively overrides the avc circuit of the R-30. This permits the R-30 to detect small changes in received signal strength, which is necessary for low-frequency range navigation. In the COMP (compass or ADF) position, full avc is switched in, and the volume control regulates the audio gain. The COMP TEST switch is used to ascertain that the radio compass indicator reading is produced by a reliable signal. It is a spring-loaded, double-throw, center-off toggle switch. When energized, it applies a voltage directly to the loop control amplifier of the R-30 to drive the loop in the direction in which the switch is held (left or right). This test voltage will override the signal circuits, so that

when the COMP TEST switch is thrown to the left or right, the loop and indicator pointer are rotated independent of the presence or absence of any signal. To check whether the indicator reading is reliable, the switch is held in either position to move the loop away from its original bearing. Upon the release of the switch, if the received signal strength is adequate and the indicator reading reliable, the loop and indicator will return to their original positions. This is a safety device to assure the operator that the ADF is operating properly, and that the signal being received is strong enough to insure the same indicator reading whether approached from a clockwise or counterclockwise direction. The tuning meter is used to facilitate accurate tuning of the R-30. In custom control panel installations, the operation and function of the C-59 is duplicated.

1–18. INDICATOR TYPE IN-12. Indicator Type IN-12 is a hermetically sealed, synchro-driven instrument which indicates the angular position of the synchro located in the loop, and the bearing of the incoming signal relative to the airplane heading. The scale of the IN-12 is graduated every 2 degrees, with every 30-degree graduation indicated by a numeral. The scale may be rotated manually by means of the VAR knob located on the front of the IN-12. The scale numerals, 10-degree graduation lines, fiducial lines, and the pointer are coated with a green phosphorescent material.

1–19. INDICATOR TYPE IN-13. Indicator Type IN-13 is similar to the IN-12 except that it is equipped with two synchros and two pointers. It is used in place of Indicator Type IN-12 in a dual ARC Type 21 ADF installation.

1–20. POWER UNIT TYPE P-14. Power Unit Type P-14 includes a dynamotor-alternator which supplies 13-volt 100-cycle a-c power to energize the loop motor and synchro system, and 125 volts dc for the electron tube plates. It also contains the filter components associated with the d-c supply. The dynamotor-alternator is speed-regulated for frequency control. The P-14 operates from the aircraft's d-c supply, and delivers all a-c and d-c power required by the ARC Type 21 ADF. The P-14 requires Mounting Type M-28 for installation. All input and output connections are made through a single connector mounted on the base.

1–21. LOOP HOUSING KIT ARC-19050. Loop Housing Kit ARC-19050 consists of a streamlined, anti-static, semi-rigid housing (ARC-17764) and the necessary hardware parts required to install the housing over Loop Type L-11. The housing is designed to protect the L-11 and reduce wind drag. It has a conductive surface to bleed off any static charges which may be built up.

1–22. MOUNTINGS. Mounting Type M-26 is usd for the R-30. Mounting Type M-28 is used for the P-14. Each is equipped with two nut and link arrangements which engage cone-shaped studs, located on the R-30 and P-14, to secure the components in place. Two flexible grounding straps are located on the underside of each mounting.

1–23. ACCESSORIES. The accessories consist of a sense antenna kit and a feed-through insulator assembly as optional equipment, two cable assemblies, and the plug connectors required to fabricate the component interconnecting cables. Antenna Cable Asesmbly ARC-17984 and Antenna Cable Asembly ARC-18637 are alternative cables used to connect the sense antenna to the R-30 receiver. Antenna Cable Assembly ARC-17984 is a seven-foot length of RG-62/U coaxial cable terminated at each end with a UG-260/U connector. Antenna Cable Assembly ARC-18637 is a fourteen-foot length of RG-114A/U coaxial cable terminated at each end with an ARC-18767 connector. ARC-17984 is much smaller in diameter than ARC-18637, and being half the length, is much lighter in weight. In their individual finished lengths, each cable assembly has a capacitance of 100 μμf, ±5 μμf. A separate special feed-through insulator assembly (ARC-19077) is available as an optional part for coupling the sense antenna through the skin of the aircraft to the antenna cable. It is desirable that this fitting be used in order to retain the electrical characteristics of the sense antenna cable assembly. This insulator assembly is supplied as part of Sense Antenna Kit ARC-19210, and therefore is not supplied as a separate part if ARC-19210 is furnished. Sense Antenna Kit ARC-19210 includes all the parts necessary for constructing and installing a sense antenna. Cable Assembly ARC-17985 is a 20-foot length (approximately) of specially designed shielded cable terminated at one end with an ARC-14599 plug connector, and on the other end with an ARC-12371 plug connector. The cable itself has been designed to have special electrical characteristics and therefore may vary slightly in length. It is used as part of the tuned loop circuit, and for this reason its length must not be altered. Its effective capacity is 350 μμf, ±5 μμf. The connectors supplied for the interconnecting cable terminations are ARC type connectors.

SECTION II
THEORY OF OPERATION

2–1. GENERAL.

2–2. OVER-ALL PURPOSE OF ARC TYPE 21 ADF. The ARC Type 21 ADF is designed to provide navigation bearings on any continuous radio signal within its operating frequency range of 190 to 1750 kc. Indicator Type IN-12 (or IN-13) shows the relative bearing of the transmitting station with respect to the heading of the aircraft. This bearing may be converted easily to magnetic bearing by turning the knob marked VAR in such a way that the indicator's azimuth scale, when at the fiducial located at the top of the indicator, reads the magnetic bearing indicated by the aircraft's compass. The pointer of the indicator will then indicate the magnetic bearing against the azimuth scale. The reading may be converted further to a true bearing by additional adjustment of the VAR knob counterclockwise for easterly variation, or clockwise for westerly variation, the appropriate number of degrees variation for the area in which the aircraft is located. The ARC Type 21 ADF also serves as a radio range receiver and a communication receiver.

2–3. OVER-ALL FUNCTIONING OF ARC TYPE 21 ADF. A simplified block diagram of the ARC Type 21 ADF is shown in figure 2–1. An r-f voltage induced by the received signal in Loop Type L-11 is properly shifted in phase, applied to a balanced modulator, and combined with a voltage induced in an omni-directional sense antenna in such a manner as to produce an amplitude-modulated resultant signal. In this arrangement, the phase of the modulation envelope reverses relative to the phase of the modulation source as the loop is rotated through a null. Thus, if the modulation envelope is detected in a conventional manner and applied to one winding of a two-phase loop-drive motor, which has its other winding driven from a fixed phase source, the direction of rotation of the loop-drive motor will reverse at the null. In the ARC Type 21 ADF the modulation is at a 100-cycle rate derived from an alternator winding on the P-14 dynamotor, and the 100-cycle voltages from the alternator and from the amplified detector output are used directly to drive the loop motor.

2–4. RECEIVER TYPE R-30.

2–5. MECHANICAL DESCRIPTION. The main mechanical units of Receiver Type R-30 are the tuning capacitor and the band-change assembly. The rotation of the tuning capacitor is accomplished by a flexible shaft

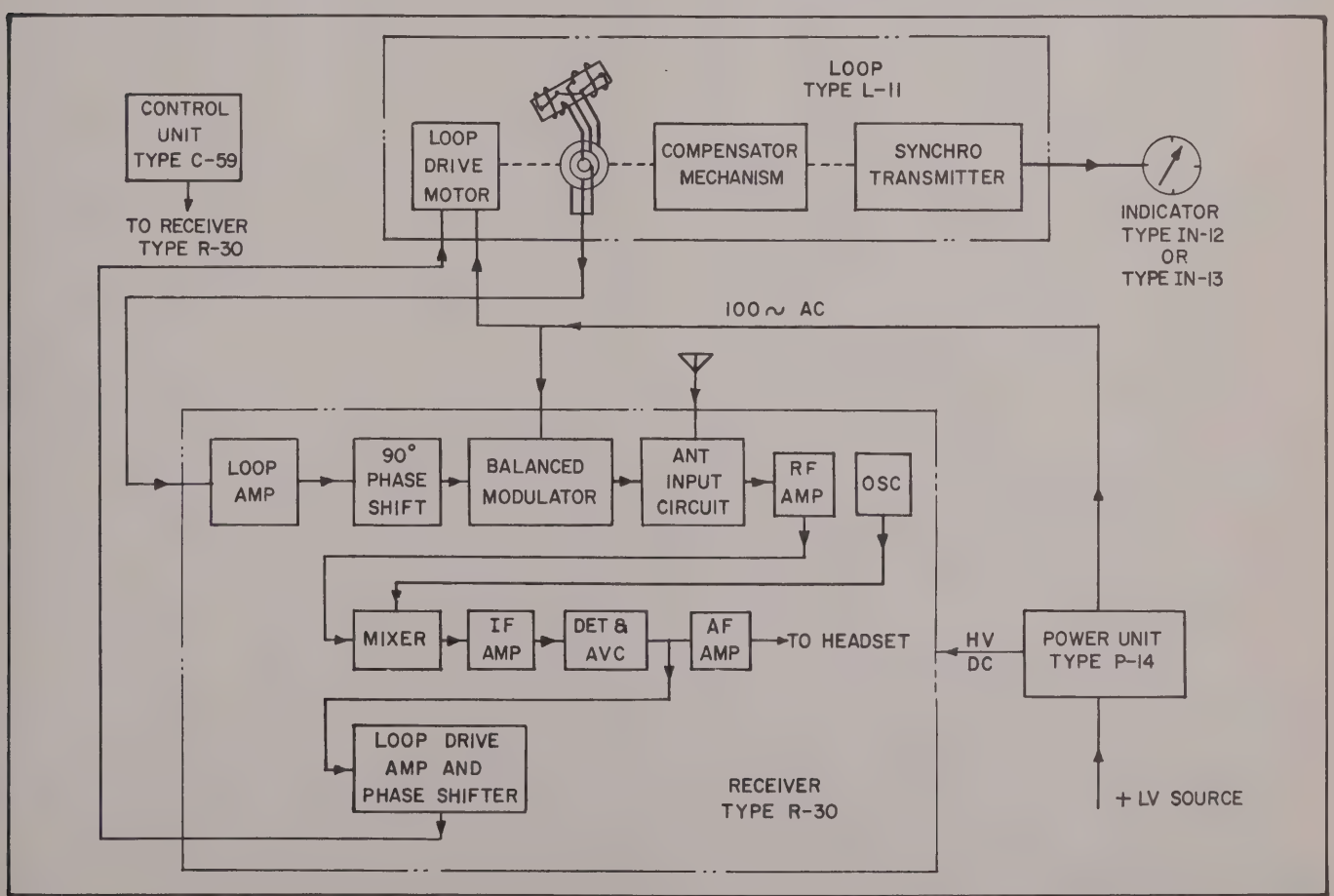


Figure 2–1. Block Diagram of ARC Type 21 ADF

connected between Control Unit Type C-59 and the R-30. The shaft is connected to the capacitor assembly through a spline which protrudes through the front panel of the receiver. This spline is geared to the capacitor through two bevel gears and a 30:1 worm gear in the tuning capacitor assembly. A spring-loaded split gear takes up backlash in the worm wheel gear system. The band switch assembly consists of a d-c motor, a 4000:1 gear train, and a motor-control switch assembly. The motor is supplied with its operating voltage through a relay which is controlled by a rotary switch connected in parallel with a cam-operated microswitch. When the rotary switch is open, and the cam follower is in the cam notch causing the microswitch to open, the motor relay disconnects the voltage from the motor and shorts the motor terminals, thereby acting as a dynamic brake. The microswitch serves as a fine control, since the cam rotates at three times the speed of the rotary switch shaft.

2–6. ELECTRICAL CIRCUIT (COMPASS OPERATION). The functioning of the R-30 electrical circuits under compass operation conditions (C-59 ANT-COMP switch in COMP position) is described in paragraphs 2–7 through 2–17. Refer to figure 6–1 for the R-30 schematic diagram, and to the other schematic diagrams of Section VI as required.

2–7. LOOP AMPLIFIER. The voltage from Loop Type L-11 is applied to the primary of a loop transformer, T101, T102, or T103, depending on the band in operation. The secondary winding of the loop transformer is resonated by C107A and coupled to the loop amplifier V101. A capacitor load (C109) of the loop amplifier retards the phase of the loop voltage 90 degrees beyond the 180-degree phase shift produced by the loop amplifier. This voltage is either in phase or 180 degrees out of phase with the sense antenna voltage.

2–8. MODULATOR. The output of the loop amplifier V101 is fed equally to the grids of V102A and V102B, the modulator. The grids of V102A and V102B are also fed at opposite phases by the 100-cycle modulating voltage, supplied by the dynamotor-alternator of the P-14, through transformer T104, which is resonated to 100 cycles by capacitor C115. The plates of V102A and V102B are connected to opposite ends of the center-tapped primary winding of an antenna transformer, T105, T106, or T107, depending on the band in operation. In effect, the modulator acts as an electronic switch which causes first one triode section and then the other to amplify the signal, thereby transferring the signal feed from one end to the other of the center-tapped primary winding. As this action takes place, the voltage induced in the secondary winding of the selected antenna transformer reverses the r-f phase on alternate halves of the 100-cycle modulating voltage.

2–9. ANTENNA CIRCUIT. The sense antenna voltage is fed to a high-impedance winding of the same antenna transformer in use by the modulator circuit (refer to paragraph 2–8). This induces a signal voltage in the secondary winding of the antenna transformer, which is added to by the signal voltage from the modulator when one of the triode sections of V102 is amplifying, and is subtracted from by the modulator signal voltage when the other section is amplifying. When the loop is oriented on the other side of its null, the reverse action occurs. The result is a 100-cycle modulation applied to the incoming signal which is either in phase or 180 degrees out of phase with the alternator voltage, depending on which side of the null the loop is oriented. The resulting r-f signal, modulated at 100 cycles, is amplified in r-f amplifier V103.

2–10. FIRST AND SECOND R-F CIRCUITS. The plate of the r-f amplifier V103 is fed to the primary winding of the first r-f transformer, T108, T109, or T110 depending on the band in use. The secondary of the transformer is tuned by C107C. The secondary is low-side coupled to a tuned winding of an identical r-f transformer, T111, T112, or T113 depending on the band in use. These transformers have a common impedance provided by choke L101, L102, or L103, respectively, for the particular band. The low impedance winding of the second r-f transformer is fed through a miniature coaxial cable to the grid of the mixer tube, V105.

2–11. OSCILLATOR. The oscillator is a tuned-plate feed-back grid type. Series padding to make the oscillator track the r-f tuned circuits over its tuning range is provided for each of the three bands by capacitor C137, C139, or C140. The grid feed-back winding of the oscillator is coupled directly to the cathode of the mixer for local injection. Resistor R119, bypassed by capacitor C136, serves as a d-c cathode load for the mixer. This resistor and capacitor are located in the oscillator section.

2–12. I-F AMPLIFIER. The oscillator frequency is 142.5 kc higher than the signal frequency, when tuned on frequency. The i-f frequency is then 142.5 kc. Double-tuned transformers are used for coupling between the mixer output and the two stages of i-f amplification, so that there is a total of three double-tuned transformers at the i-f frequency.

2–13. DETECTOR. The output of the second i-f amplifier is coupled to the detector by the double-tuned transformer Z109. The detector output is derived from the low side of the secondary winding of Z109 and is filtered by capacitors C161 and C163, and resistor R130. The d-c return is through resistor R131.

2–14. AUDIO AMPLIFIER. The detector output is coupled to a conventional triode amplifier, V109B, for audio output. This tube is coupled to a final audio amplifier, V110. Control of volume takes place in the grid circuit of V110 through the volume control located in Control Unit Type C-59.

2–15. 100-CYCLE AMPLIFIER. The detector output at the junction of C163 and R131 is coupled to a 100-cycle loop amplifier whose output drives one phase of the loop motor. This coupling is provided to the first amplifier section, V111, through resistor R141 and coupling capacitor C169. The plate of V111 is coupled to amplifier V112A through two resistor-capacitor filter combinations, R147-C170 and R148-C171. This filter suppresses harmonics of 100 cycles and also provides proper phase

relationship for driving the loop motor. Triode V112B serves as a phase inverter. The output of this triode and of V112A drives push-pull stages V113 and V114. The output transformer for this 100-cycle amplifier is located in Power Unit Type P-14. The output of the transformer is coupled through the interconnection of the system to the loop motor.

2—16. AVC CIRCUIT. The plate of the second i-f amplifier feeds the avc diode V108, terminals 5 and 7. Automatic volume control delay is accomplished by the avc clamp tube V109A and associated resistors R132, R133, and R134. When the detector output is below approximately —10 volts, developed at the detector diode, avc action does not take place. Under these conditions, i.e., prior to the avc delay point, avc clamp tube V109A is conducting, inasmuch as there is a positive voltage at the junction of R133 and R134. However, the avc does not go positive due to the conducting action of this diode. When the developed negative voltage at the avc detector plate, terminal 5 of V108, exceeds this level, the avc clamp tube no longer conducts and the avc line is allowed to go negative, according to the signal strength under which the receiver is operating. This avc controls the grid bias of r-f amplifier V103, mixer V105, and first i-f amplifier V106.

2—17. DISABLING CIRCUIT. When the band selector is in operation it is desirable that the audio output be eliminated to exclude any undesired noise in the headphones of the receiver. This action takes place through resistors R136 and R137 in the cathode circuit of V109B. While the band selector is in operation, 27.5 volts (or 13.7 volts) is impressed on one end of R136 which applies a positive bias to V109B, so that amplification does not take place in this stage during this time.

2—18. ELECTRICAL CIRCUIT (ANTENNA OPERATION). When Control Unit Type C-59 is in the ANT position, the function of Receiver Type R-30 is the same as described in paragraphs 2—7 through 2—17 for the COMP position, except for the modulator and volume control circuits. These differences are described in paragraphs 2—19 and 2—20.

2—19. MODULATOR. During ANT operation the modulator is de-energized. The C-59 function switch grounds terminal D of the R-30 power receptacle J103, which is connected to terminal 3 of antenna subassembly Z103. This grounds the plate-end of series resistor R114, located in Z104, the first r-f subassembly.

2—20. VOLUME CONTROL. During ANT operation, the VOL control of Control Unit Type C-59 functions as an r-f sensitivity control instead of an audio level control. This is effected by ungrounding the lead to terminal K of J103 in the R-30, and allowing the resistance between this point and ground to be varied by R201A located on the VOL control shaft in the C-59. This potentiometer thus varies the cathode bias of the r-f amplifier V103 and the first i-f amplifier V106, the cathode loads of which are returned to the SENS line, terminal K of J103. Resistor R124 applies a limited amount of d-c current from the HV2 supply to the SENS line, to insure a sufficient reduction in sensitivity under very high signal level conditions. The audio gain is held nearly constant at maximum gain during ANT operation. The C-59 ANT-COMP switch disconnects the low side of the audio potentiometer for ANT operation. By maintaining maximum audio gain and controlling the r-f sensitivity during ANT operation, the R-30 operates below the avc delay point when the output is set at a comfortable level. This characteristic is desirable when receiving low-frequency radio range transmissions that do not have an omnidirectional radiated carrier, since operating below the avc delay point precludes the ambiguity of the A and N coded sidebands.

2—21. LOOP TYPE L-11.

2—22. A description of the mechanical characteristics of Loop Type L-11 is given in paragraphs 1—13 through 1—16. Directional properties of the loop are such that no voltage is induced in its coil when the ferrite bar is in line with the line of travel of the received signal. A maximum voltage is induced when the loop is oriented 90 degrees from this position. The voltage induced in the loop is 90 degrees out of phase with the voltage induced in the sense antenna, and lags or leads the sense voltage depending on which side of the null position the loop is oriented. The phase of the voltage induced in the loop then reverses 180 degrees as the loop is rotated through its null position. When the ARC Type 21 ADF is operating in the COMP position, that is, as an ADF, the loop is driven to its null by means of a two-phase motor. One phase of input for this motor is derived directly from the 100-cycle output of the dynamotor-alternator on Power Unit Type P-14. The other is obtained from Receiver Type R-30. The direction in which the motor drives the loop depends on whether the loop voltage lags or leads the sense voltage by 90 degrees. The same end of the ferrite bar always points toward the station received, thereby precluding 180-degree ambiguity of the reading. Loop position information is transferred to either Indicator Type IN-12 or Type IN-13, whichever is installed, by means of a synchro-transmitter contained in Loop Type L-11, and a synchro-receiver contained in the indicator. The direction of signal arrival is distorted by the structure of the aircraft; and since this would cause the indicated bearing to be in error, the angular position of the loop synchro is modified as required by an adjustable mechanical compensating system (described in paragraphs 1—13 through 1—16) located between the loop shaft and the shaft of the synchro-transmitter.

2—23. CONTROL UNIT TYPE C-59.

2—24. GENERAL. Control Unit Type C-59 includes a function switch identified as ANT-COMP, a VOL control, a COMP TEST switch, a tuning crank, a tuning meter, and a BAND switch. The frequency dial is displayed on a drum, an arrangement which has the advantage of providing equal dial length for all three bands. The BAND switch, above the dial, actuates a masking drum which surrounds the frequency dial drum, allowing only the band in operation to be visible. The ANT-

COMP switch permits Receiver Type R-30 to be used for reception of radio ranges, as well as for radio compass operation. When this switch is in the ANT position, the loop and modulating circuits are de-energized and the VOL control becomes an r-f sensitivity control. In the COMP position, the loop and modulating circuits are energized, and the VOL control functions as an audio level control with the r-f sensitivity controlled by the avc. The COMP TEST switch is used to ascertain that the reading observed on Indicator Type IN-12 (or Indicator Type IN-13) is produced by a reliable signal, and that the equipment is functioning properly. When this switch is depressed to the left or right, the loop and indicator pointer are rotated independent of the presence or absence of any signal. If the indication is reliable, the pointer returns to its original position when the COMP TEST switch is released. The tuning meter provides a means of accurately tuning the receiver to the received signal by tuning for maximum deflection.

2–25. "COMP" OPERATION. With the ANT-COMP switch in the COMP position, the circuitry of the C-59 functions as follows:

The negative terminal of the tuning meter is grounded by S204. This grounds terminal P of J210 through the tuning meter. Receiver Type R-30 then operates at maximum r-f gain with no signal, and the gain is regulated according to signal strength by the avc action.

The cathode current of the r-f and first i-f amplifiers of the R-30 flows through the tuning meter. The meter is arranged with a zero-current indication at the right. With no signal input the meter reads to the left. As the signal input is increased, the negative avc line voltage increases, and the total cathode current of these amplifiers decreases, causing the meter to read further to the right.

The low side of the audio volume control potentiometer, R201B, is grounded. The audio level control then functions to control the aural output of the R-30.

The Band selector switch, S203, grounds terminal F, G, or H of J201, as required.

The COMP TEST switch, S201, permits connecting terminal K of J201 to either terminal L or M. Terminal L is connected directly to the 100-cycle output of the dynamotor-alternator in installations where the sense antenna is installed on the bottom of the aircraft. Terminal M, connected to a phase-reversing transformer located in Power Unit Type P-14, provides a voltage 180 degrees out of phase with the voltage on terminal L in bottom sense antenna installations. Terminals L and M are interchanged on top-mounted sense antenna installations by the interconnecting cable.

The power on-off switch S202, which is part of the VOL control, grounds lead Q of J201 when the equipment is turned on. This energizes the power relay in the P-14.

2–26. "ANT" OPERATION. With the ANT-COMP switch in the ANT position, the circuitry of the C-59 functions as follows:

Terminal R of J210 is grounded. This removes the plate voltage from the modulator circuit in the R-30, de-energizing the loop circuits.

The sensitivity potentiometer R201A is connected into the circuit so that the VOL control functions as an r-f sensitivity control.

One end of the audio level potentiometer is removed from ground. The a-f gain is then always near its maximum value.

In ANT operation, the tuning meter is affected by the position of the VOL control in such a way that it reads further to the right as the r-f gain of the receiver is decreased by turning the control counterclockwise.

2–27. POWER UNIT TYPE P-14.

2–28. Power Unit Type P-14 operates from the aircraft's 14- or 28-volt d-c supply and delivers all power required by the ARC Type 21 ADF. The P-14 consists of a dynamotor-alternator, the filter components for the d-c supply, the power relay, a phase-reversing transformer, and the output transformer for the 100-cycle amplifier. The dynamotor-alternator supplies the a-c power required to energize the loop motor and synchro system and the d-c power required for electron tubes. The dynamotor-alternator is speed-regulated by a centrifugally actuated switch which shunts a series-connected resistor located in the field circuit of the motor end of the dynamotor-alternator.

2–29. Choke L301 and capacitor C304 form a filter at the input of the P-14 to filter out unwanted noise that may originate from the aircraft's d-c supply. Chokes L302 and L303, plus capacitors C305, C306, and C308, form a filter for the dynamotor-alternator d-c output. Relay K301 is the power relay for the ARC Type 21 ADF. The relay is energized when terminal I of J301 is grounded. Resistor R301 drops the voltage applied to the heaters of the R-30 electron tubes so that the average heater voltage on each tube is 6.3 volts when the aircraft supply is at 27.5 volts. This resistor is not used in 14-volt equipments. Transformer T301 is the output transformer for the loop amplifier circuit located in the R-30. The output of this transformer drives one phase of the two-phase loop motor. The input of this transformer is fed from the push-pull amplifier, consisting of V113 and V114, located in the R-30.

2–30. INDICATORS TYPE IN-12 AND IN-13.

2–31. Two types of indicators are available for use with the ARC Type 21 ADF. Indicator Type IN-12, used in single ADF installations, is a hermetically sealed unit consisting of a synchro receiver with a direct mounted pointer, and a compass card which is adjustable by the operator by means of a knob, marked VAR. The synchro receiver rotor orients itself to the same angular position as the synchro transmitter in Loop Type L-11.

2–32. Indicator Type IN-13, used in dual ARC Type 21 ADF installations, contains two synchro receivers, each driving a pointer on the same axis of rotation. The synchro units are also on the same axis, and the shaft of the rear unit passes through a hollow shaft of the forward synchro. Like the IN-12, the compass card may be rotated by an external knob. The IN-13 is also hermetically sealed.

SECTION III
INSTALLATION AND ADJUSTMENT

3—1. INSTALLATION CONSIDERATIONS.

3—2. The location and installation of the ARC Type 21 ADF will vary with each particular type of aircraft. However, there are some general requirements, applicable to all types of aircraft, which should be considered when planning the installation. These are:

The available installation area and component dimensions. Refer to figures 3—1 through 3—8, the outline dimensional diagrams, and compare the requirements shown thereon with the area being considered. (Overall dimensions for the individual components are given in table 1—1.) Locate the components so that they are accessible for inspection and maintenance, and in such an area as to be free from excessive vibration and heat.

The location of Receiver Type R-30, Control Unit Type C-59, and Power Unit Type P-14. The R-30 should be installed reasonably close to the C-59 to avoid the use of an excessive length of mechanical linkage. The C-59 should be installed within convenient view and reach of the operator. The P-14 may be installed at any convenient location. Allow sufficient clearance on all sides of the R-30 and P-14 for shock-travel and ventilation, and sufficient space in front of each of these components to permit easy removal from their mountings. Enough space should be available to permit cable connections to be made, and the cable should be arranged so as not to restrict shock-mount travel.

The location of Indicator Type IN-12 or Indicator Type IN-13. These components are intended for mounting on a shock-mounted instrument panel, and should be located within convenient reach and view of the operator.

The location and installation of Loop Type L-11. The L-11 may be mounted on either the top or bottom of the aircraft, but should be located as near the center-line of the aircraft as possible. Consideration should also be given to keeping the loop away from other antennas and structural members which may cause distortion of the radio field pattern. A special installation procedure for the loop housing is required. For details, refer to paragraphs 3—17 through 3—21. Because the length of the loop cable assembly is critical and cannot be altered, the distance between the L-11 and the R-30 must not exceed the cable length of approximately 20 feet.

The characteristics of the sense antenna. In practice it is difficult to achieve optimum antenna arrangements on any but the largest aircraft, and even there certain compromises are the rule rather than the exception. Extensive flight tests indicate that satisfactory performance of the ARC Type 21 ADF can be achieved by the use of the so-called "standard" range antenna. The most satisfactory type of wire antenna is the balanced or symmetrical "T," although an inverted "L" or unbalanced "T" will provide acceptable results. The balanced "T" antenna is preferred to the inverted "L" because it is not responsive to horizontally polarized transmissions that are radiated by LF radio range stations of the older loop type. This response to horizontal radiation is undesirable since it may cause the pilot to "overshoot" when approaching a radio range course. The horizontal response may also cause some course error when operating as a range receiver on loop stations. The flat-top portion of the antenna should not be less than 12 feet in length. Additional length up to 20 feet will result in increased performance. The average clearance between the antenna and the skin of the aircraft should be 12 inches or more. When used with a "T" antenna, the ARC Type 21 ADF permits accurate orientation on LF ranges through the use of "builds" and "fades," as well as providing accurate "cone of silence" indications.

The location of the sense antenna feed-through assembly ARC-19077. The feed-through for the sense antenna may be mounted on either the top or bottom of the aircraft, depending on the location of the sense antenna, preferably as near the center-line of the aircraft as possible. The lead-in should be located approximately at the center of area of the horizontal projection of the aircraft. With normal aircraft configuration and normal wing position, this usually places the sense antenna lead-in between 45 and 55 percent of the distance from the nose to the tail of the aircraft.

The length of the loop and sense antenna cables. The loop cable assembly is approximately 20 feet long and functions as part of the tuned loop circuit. *Its length must not be altered.* The cable may be coiled if the distance between the R-30 and L-11 does not require the full extended length. The sense antenna connecting cable is supplied in either a 7-foot or 14-foot length. (Where extremely short runs are encountered, it may be more convenient to fabricate a $3\frac{1}{2}$-foot section of RG-58/U cable locally, although no performance advantage would result.) Each of these sense antenna cables has a capacitance of 100 $\mu\mu$f. To maintain proper antenna tuning, the length of these cables should not be altered. The 7-foot cable is much preferred because of its light weight, flexibility, and ruggedness.

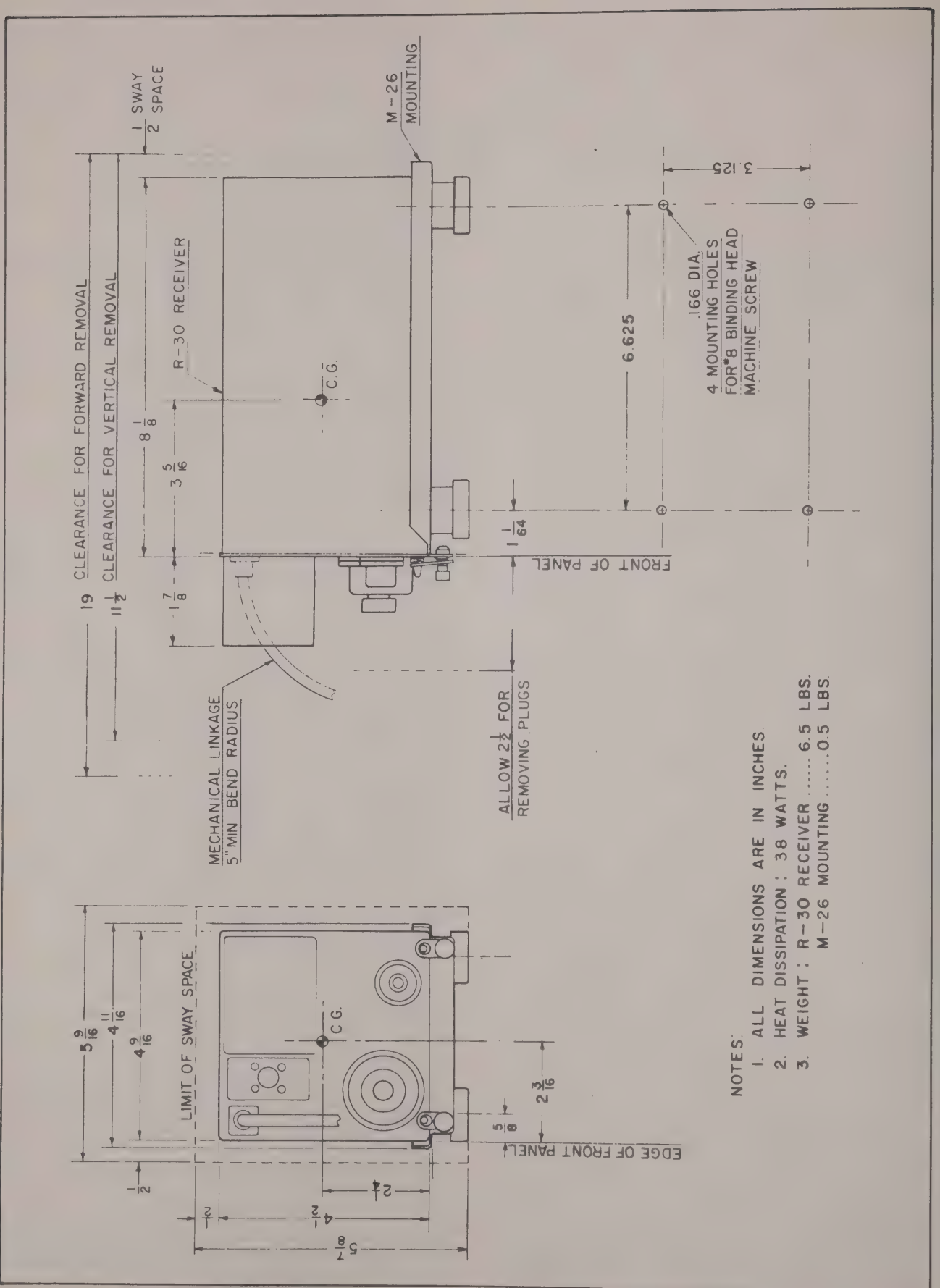


Figure 3–1. Receiver Type R-30, Outline Dimensions

3–3. INSTALLATION OF RECEIVER TYPE R-30 AND MOUNTING TYPE M-26.

3–4. Installation dimensions for Receiver Type R-30 installed on Mounting Type M-26 are shown in figure 3–1. Installation dimensions for the M-26 alone are shown in figure 3–2. The mounting surface for the M-26 may be tapped or drilled for securing the M-26 in position. To install the M-26 and R-30, proceed as follows:

Step 1. Drill or tap the aircraft mounting surface for four #8 screws, located as shown in figure 3–1.

Step 2. If tapped holes are used, place a #8 internal tooth lock washer on each of four #8 binding head screws, and insert the screws through the top of each vibration mount.

Step 3. Curve the two flexible ground straps and thread the end of the adjacent screw through the hole in each strap. Place the M-26 in position on the mounting surface.

Step 4. Secure the M-26 by tightening the four mounting screws, or use nuts and internal tooth lock washers, and tighten.

Step 5. Loosen the knurled thumb-nuts on the front of the M-26 so that the associated links point down. Slide the R-30 receiver onto the M-26 mounting. Rotate the links so that their holes engage the conical studs on the front of the R-30. Tighten the thumb-nuts to secure the R-30 on the M-26.

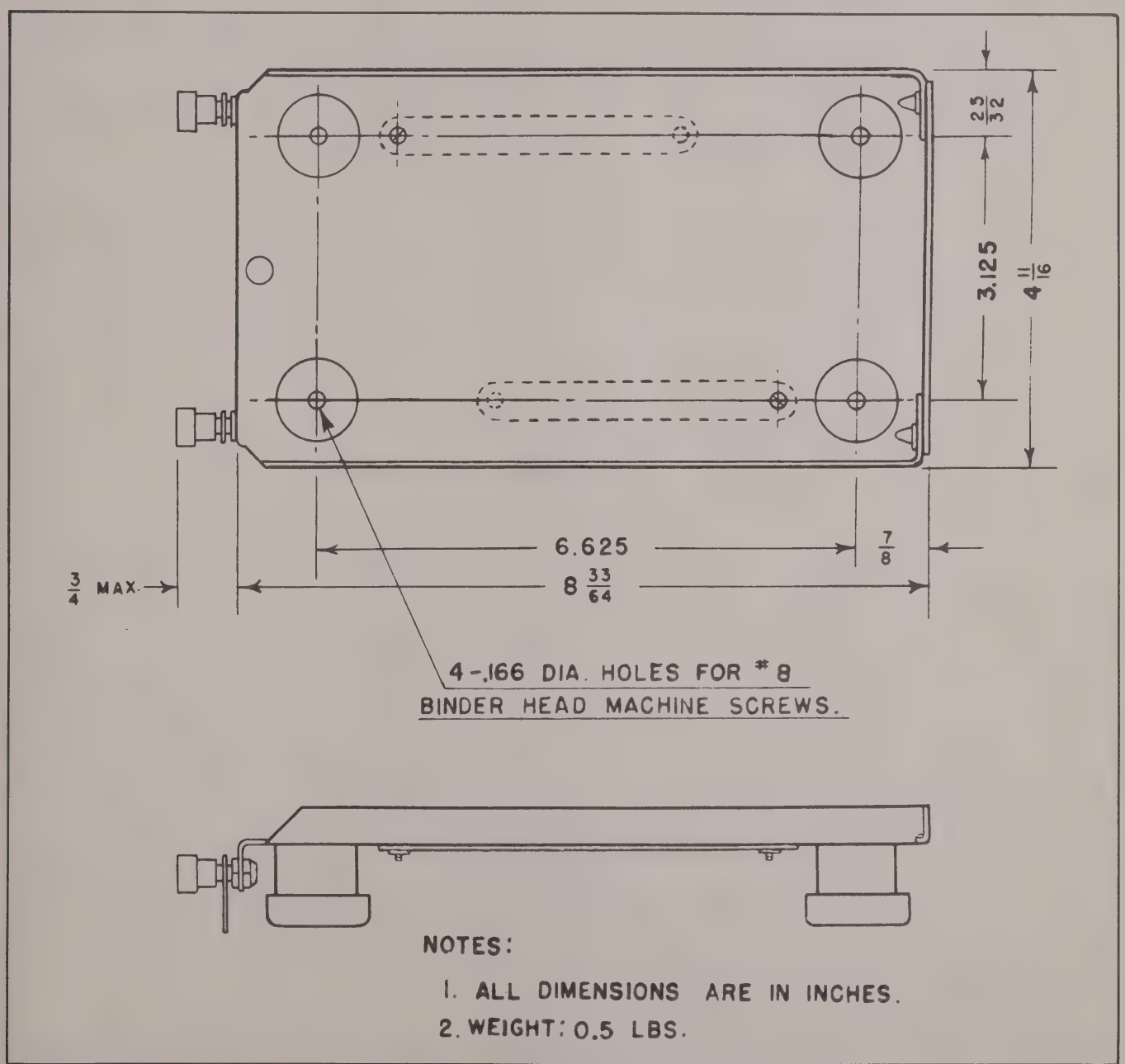


Figure 3–2. Mounting Type M-26, Outline Dimensions

3–5. INSTALLATION OF CONTROL UNIT TYPE C-59.

3–6. Installation dimensions for Control Unit Type C-59 are shown in figure 3–3. The C-59 is designed for installation on a standard AN. console panel. It is secured to the console by means of four dzus-type fasteners. Installation diagrams for custom control parts which duplicate the function of the C-59 are shown in figures 6–20 and 6–21.

3–7. INSTALLATION OF INDICATOR TYPE IN-12 OR INDICATOR TYPE IN-13.

3–8. Except for the difference in depth, Indicators Type IN-12 and IN-13 have the same installation dimensions (see figures 3–4 and 3–5). The indicator used should be installed on a shock-absorbing panel, or should be shock-mounted. It may be mounted either from the front or rear of the panel, using three #8-32 screws. The knob shaft is extendable so that it will fit Beechcraft and similar instrument panels. To extend the shaft, loosen the *forward* set screw in the shaft coupling, pull the shaft forward as desired, and retighten the set screw.

CAUTION

Indicators of the ID-90 series and similar types not designed for operation on 13 volts, 100 cycles must not be substituted for the IN-12 or IN-13 indicator; however the ID-250 RMI may be used with the ARC Type 21 ADF using a 26-volt 400-cycle supply for the indicator and the transmitter synchro in Loop Type L-11.

3–9. INSTALLATION OF POWER UNIT TYPE P-14 AND MOUNTING TYPE M-28.

3–10. Installation dimensions for Power Unit Type P-14 with Mounting Type M-28 are shown in figure 3–6. Mounting dimensions for the M-28 alone are shown in figure 3–7. The installation of the M-28 and P-14 is similar to that described in paragraph 3–4 for Mounting Type M-26 and Receiver Type R-30.

3–11. INSTALLATION OF SENSE ANTENNA FEED-THROUGH INSULATOR ARC-19077.

3–12. To install the feed-through insulator, proceed as follows:

Step 1. If necessary, place a doubler at the feed-through insulator location to provide a total thickness of at least 0.040 inch.

Step 2. Drill a 3/8-inch hole through the doubler and the aircraft skin.

Step 3. Mount the connector in the hole using the formed washer and the hexagon nut.

Step 4. Slide the cap assembly over the antenna down-lead. Place the down-lead through the cross-hole in the terminal of the receptacle and solder so that the down-lead is aligned with the center line of the receptacle.

Step 5. Cut off the excess of the down-lead wire. Screw the cap assembly onto the receptacle.

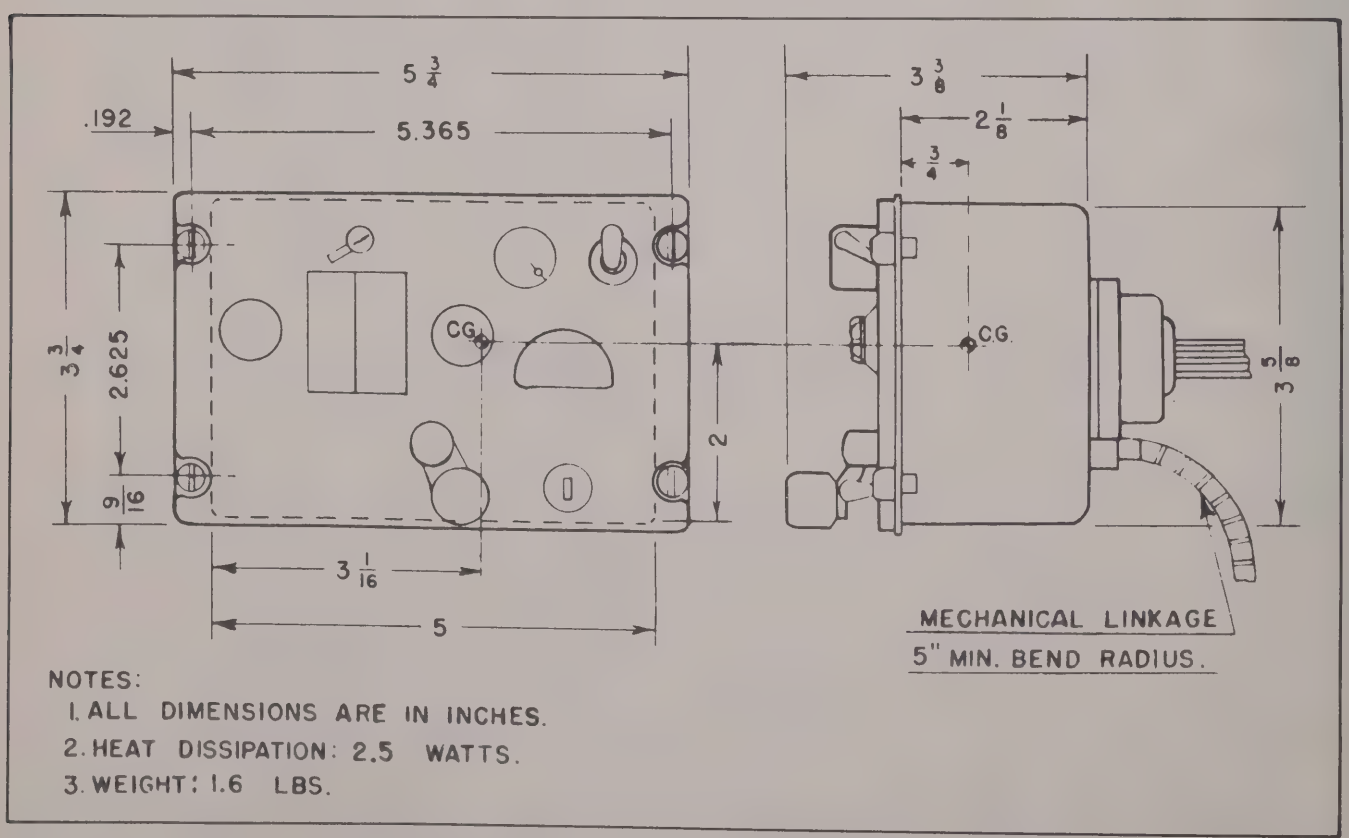


Figure 3–3. Control Unit Type C-59, Outline Dimensions

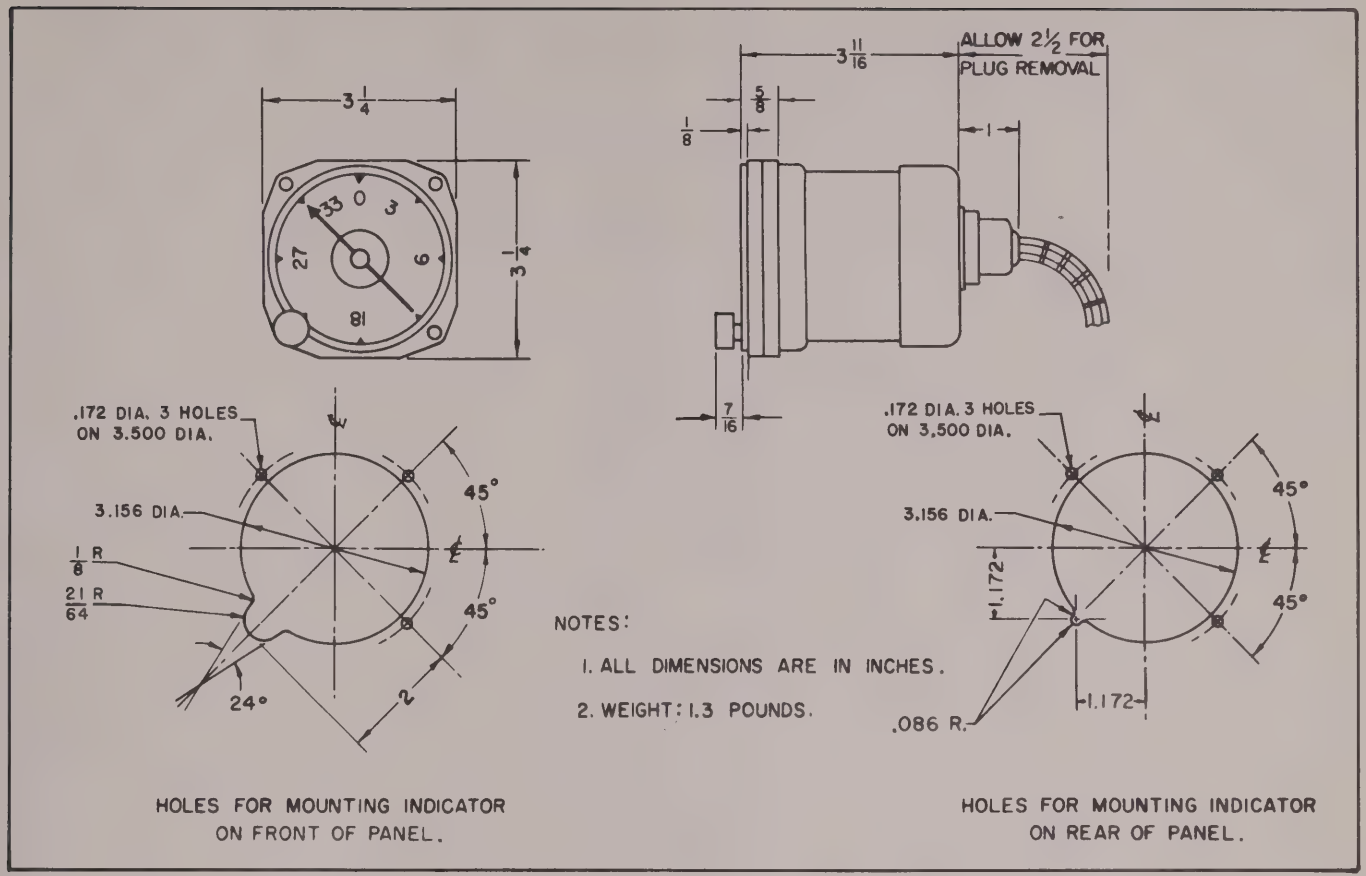


Figure 3–4. Indicator Type IN-12, Outline Dimensions

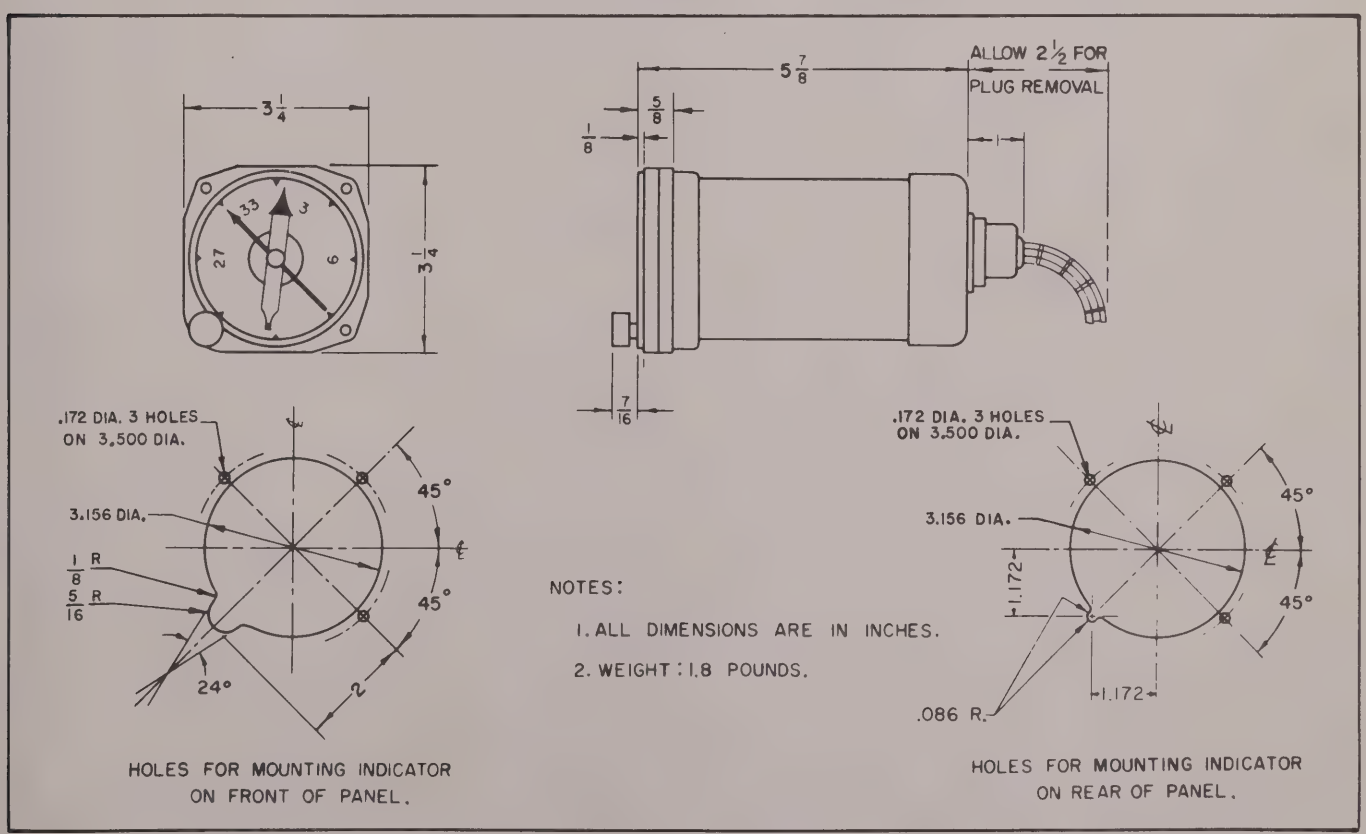
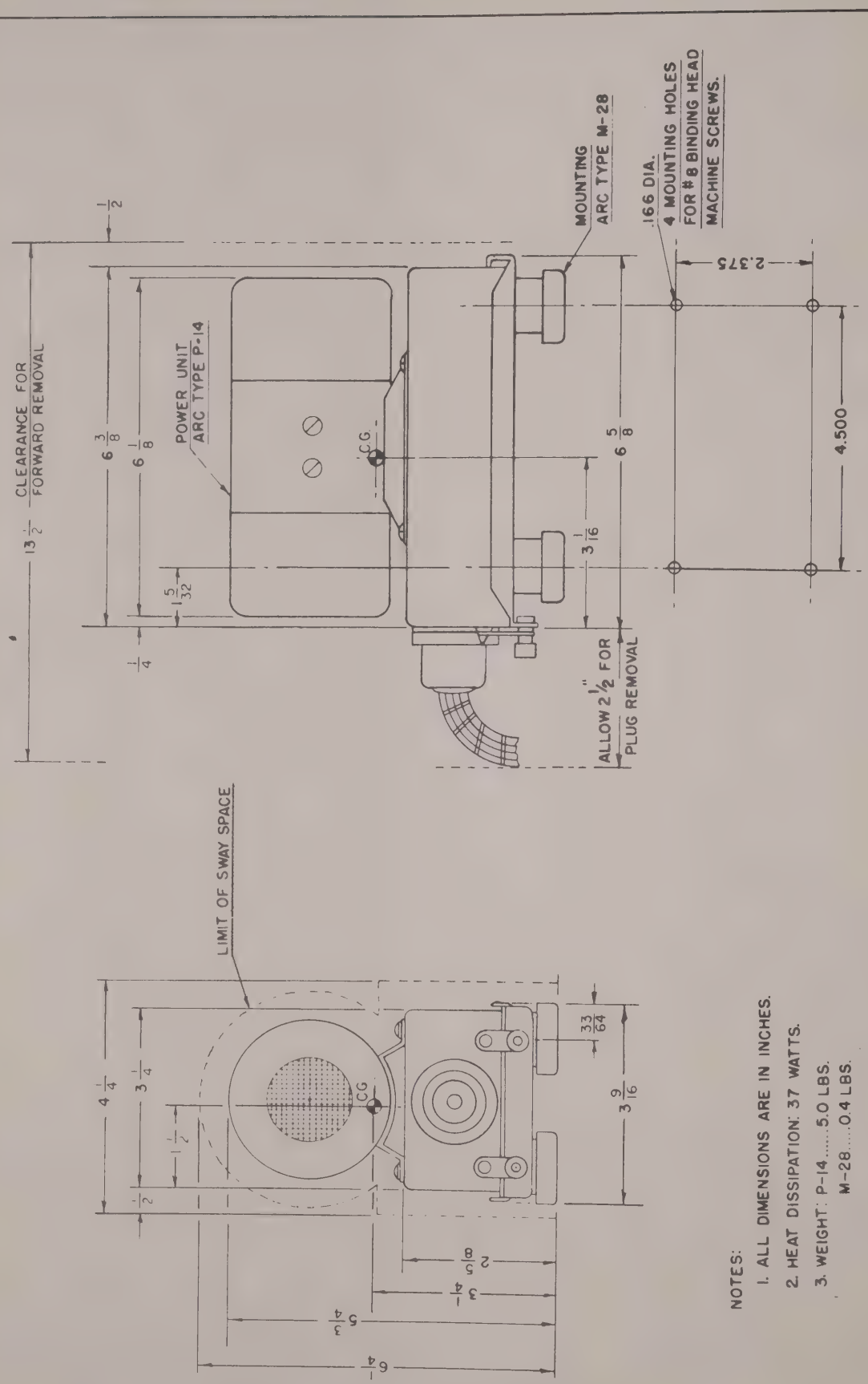


Figure 3–5. Indicator Type IN-13, Outline Dimensions



NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. HEAT DISSIPATION: 37 WATTS.
3. WEIGHT: P-14.....5.0 LBS.
   M-28.....0.4 LBS.

Figure 3–6. Power Unit Type P-14, Outline Dimensions

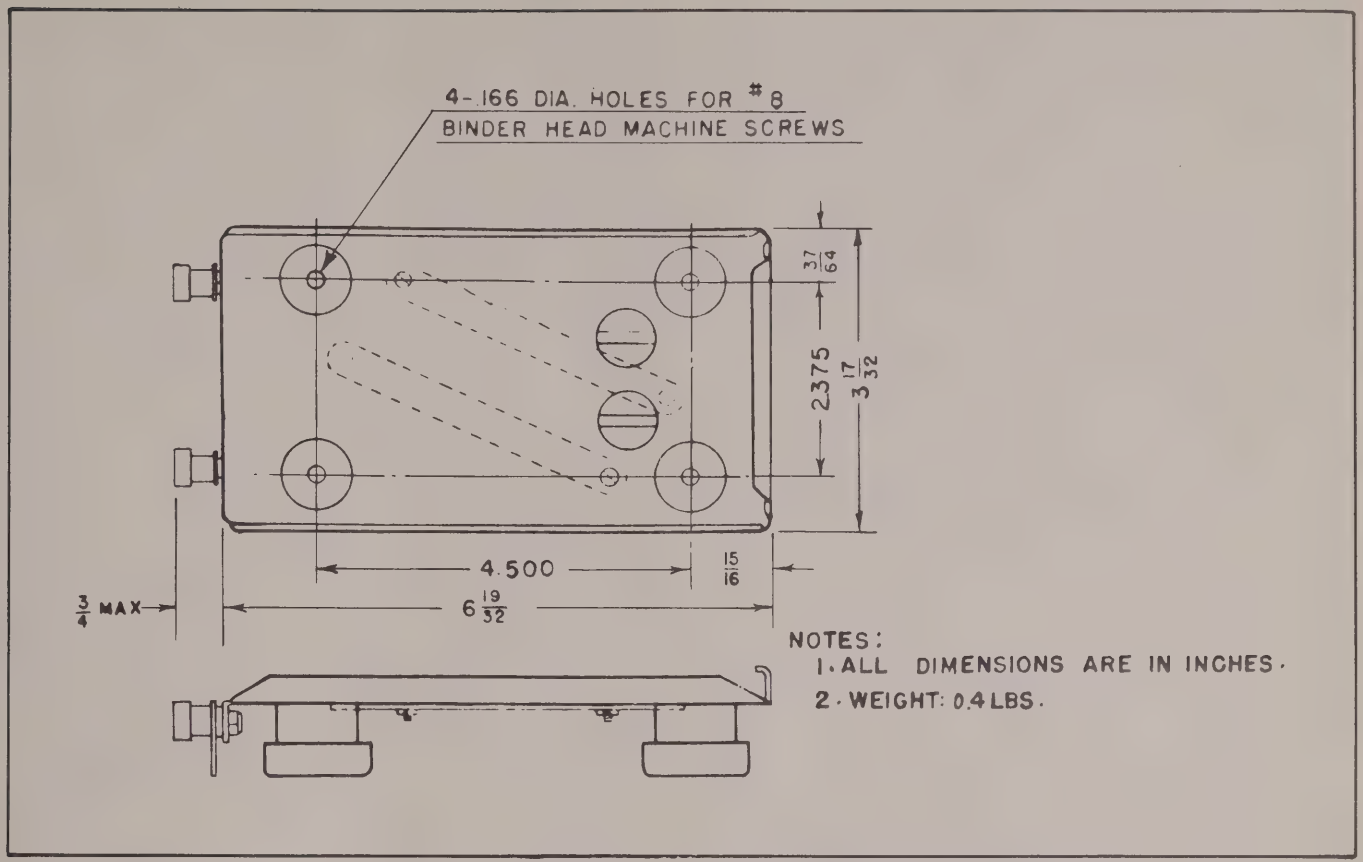


Figure 3–7. Mounting Type M-28, Outline Dimensions

3–13. INSTALLATION OF SENSE ANTENNA.

3–14. The sense antenna may be made from Sense Antenna Kit ARC-19210. General installation requirements are discussed in paragraph 3–2. Actual installation requirements will vary with each type of aircraft. The use of "T" and "L" antenna types for the sense antenna is also discussed in paragraph 3–2. For best over-station reversal, the null of the antenna pattern should be as nearly straight down as possible.

3–15. INSTALLATION OF LOOP TYPE L-11.

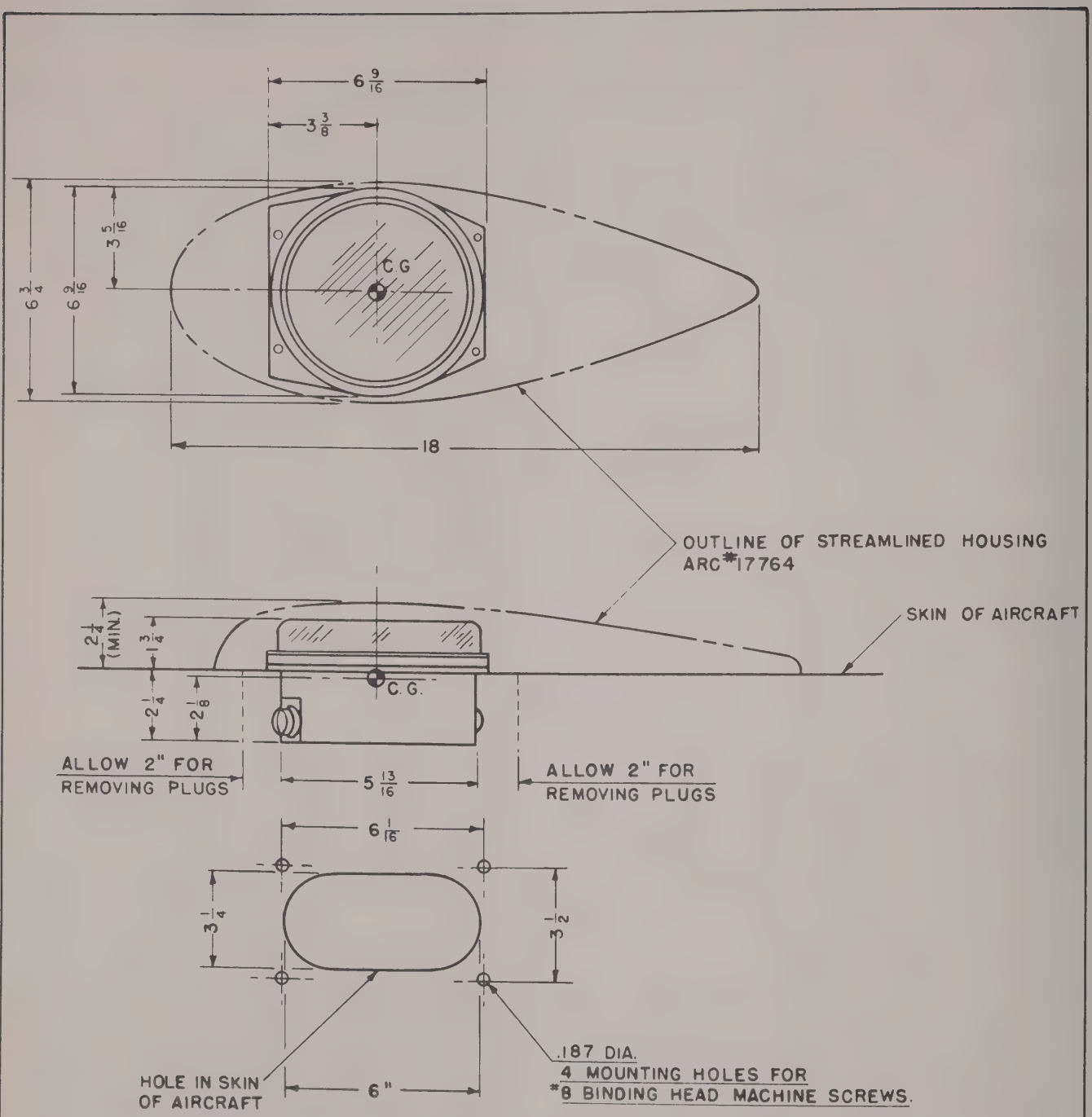
3–16. The shape and size of the cut-out required for Loop Type L-11, and the other installation dimensions are shown in figure 3–8. The L-11 should be mounted with the forward and aft fiducial lines aligned with the fore-and-aft line of the airplane, and as nearly on the center line of the airplane as is practical. Factors to be considered for the installation are the interior and exterior space available, the length of the cable connection, and the remoteness from aircraft structural parts which present local distortion of received electromagnetic waves. In dual installations, the loops should be separated from each other by at least 3 feet.

3–17. INSTALLATION OF HOUSING KIT ARC-19050 FOR LOOP TYPE L-11.

3–18. GENERAL. The procedure required to install Housing Kit ARC-19050, after Loop ARC Type L-11 has been installed, will depend on the contour of the surface on which it will be installed. The housing, ARC-17764, should be mounted over the L-11 as far rearward as possible. If the housing is to be installed on a flat surface, cut and trim it just up to the bottom edge of the tapeline. Do not cut into the tape, as insufficient material will be left to permit proper attachment of the housing. If the housing is to be mounted on a curved surface, it must be cut to conform to the contour of the mounting surface. The height of the housing should be reduced as much as possible, consistent with the installation requirements, but without cutting into the tape. In general, the cutting line will be tangent to the tape at two points; usually, the front and rear. The tape may be removed after the housing has been trimmed to its final shape.

3–19. MATERIAL SUPPLIED. Housing Kit ARC-19050 includes the following parts:

Qty	Description	ARC Part No.
1	Housing	17764
8	Bracket	19039
1	Gasket	18744
8	Screw	8813
1	Tube, Pliobond No. 30 Cement	8818
1	Installation Instructions	—



NOTES:

1. ALL DIMENSIONS ARE IN INCHES.
2. HEAT DISSIPATION 5 WATTS.
3. WEIGHT 4.5 LBS.

Figure 3–8. Loop Type L-11, Outline Dimensions

3–20. INSTALLATION OF HOUSING KIT ARC-19050. The following is the recommended method for marking the housing, to determine the portion to be removed, and for installing it together with the other parts of the housing kit.

Step 1. Locate the housing over the L-11, as far rearward as the L-11 will permit, with the major axis of the housing parallel with the line of flight. Then move the housing straight forward three-quarters of an inch (to provide clearance for the rubber gasket which will be installed later), and support it to prevent rocking (see figure 3–9). Mark the positions of the forward and aft ends of the housing on the airplane skin.

Step 2. Using dividers set for 1-3/4 inches, scribe a line on the housing 1-3/4 inches away from the skin of the aircraft at the line where the housing will eventually touch the airplane (see figure 3–9). During this procedure, the housing should be supported by the front and rear of the housing, and the temporary supports.

Step 3. Using a saw, or duck-bill tin snips, and a file, cut and trim the housing just up to the scribed line. Do not cut into the tape.

Step 4. Hold the fitted housing in place over the L-11 loop, centrally located (sideways) over the L-11 loop mounting flange with its major axis parallel to the line of flight, and with its forward and aft ends at the positions marked in Step 1 of this procedure.

Step 5. Draw an outline of the housing on the airplane surface.

Step 6. Remove the housing and select five or six locations for installing brackets ARC-19039, as shown in figure 3–10.

Step 7. The screws necessary for attaching the brackets to the skin of the airplane are not supplied; however, #6 screws are recommended. Drill the required number of holes of the proper size in the airplane skin one-half inch in from the housing outline (see figure 3–10). Install each bracket with its drilled hole placed against the mounting surface and the vertical portion of the bracket parallel to the housing outline on the airplane. Washers or plate nuts may be placed inside the airplane to provide stress distribution.

Step 8. Mark a hole-center extension line outward from the brackets on the skin of the airplane (see figure 3–10), so that the bracket-hole locations will be apparent when the housing is in place.

Step 9. Replace the housing, and using these extension lines as a guide, mark vertical lines on the housing at each of the bracket locations (see figure 3–11).

Step 10. Cross-mark each of the vertical lines on the housing at a point three-eighths of an inch from the airplane skin; this dimension allows for the thickness of the formed rubber gasket, ARC-18744.

Step 11. Remove the housing and drill 0.144-inch (#27 drill) holes at the marked locations.

Step 12. Using the Pliobond No. 30 Cement supplied, cement the gasket, with its flange on the outside of the housing, to the housing, making sure that the rim of the housing is well-seated in the groove of the gasket; also, cement the butted ends of the gasket. To insure proper adhesion and seating of the housing and gasket, complete the installation of the housing as described in Steps 13 and 14 before the cement is thoroughly dry.

Step 13. (For top installation only, use Pliobond No. 30 Cement between the contact surfaces of the gasket and airplane.) Place the housing over the rear four brackets, slide it forward and over the forward bracket(s), distorting the forward end of the housing slightly outward if necessary to get the housing over the bracket(s) without displacing the gasket.

Step 14. Thread the required number of truss head screws (supplied) loosely into each bracket. Then, applying sufficient pressure to the surface of the housing to make it fit closely to the mounting surface, tighten each screw.

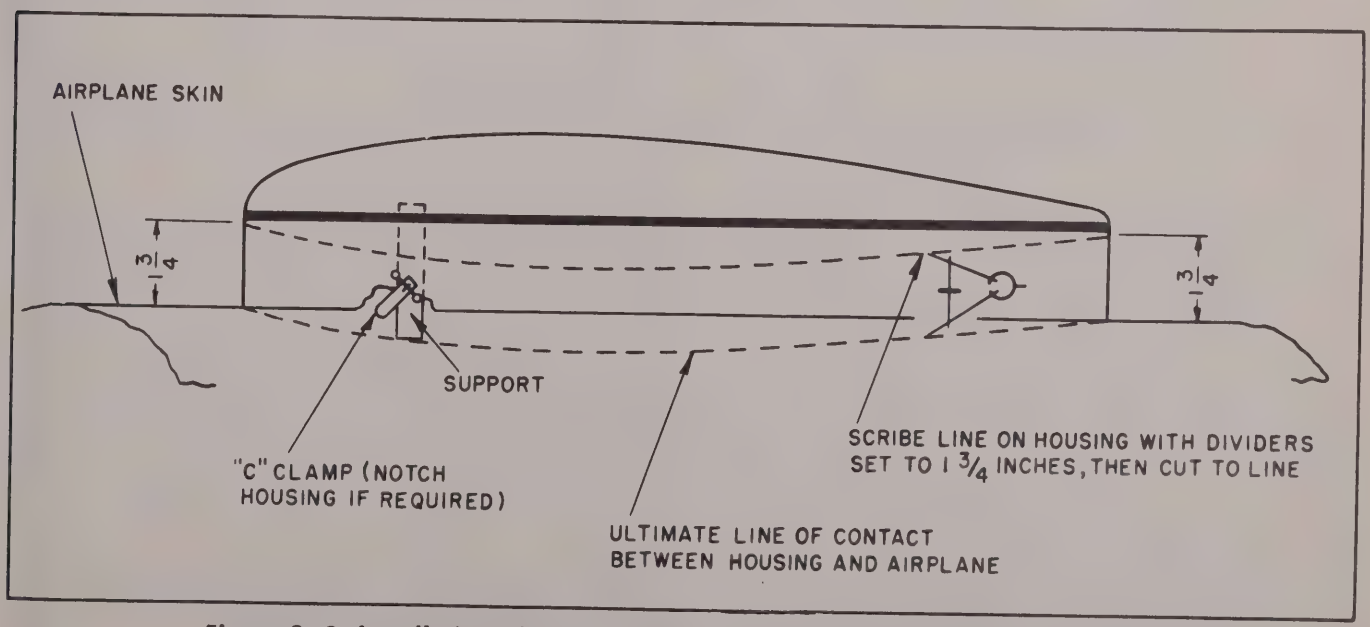

AIRPLANE SKIN
3/4
3/4
SUPPORT
"C" CLAMP (NOTCH HOUSING IF REQUIRED)
ULTIMATE LINE OF CONTACT BETWEEN HOUSING AND AIRPLANE
SCRIBE LINE ON HOUSING WITH DIVIDERS SET TO 1 3/4 INCHES, THEN CUT TO LINE

Figure 3–9. Installation of Housing ARC-17764 for Fitting to Mounting Surface

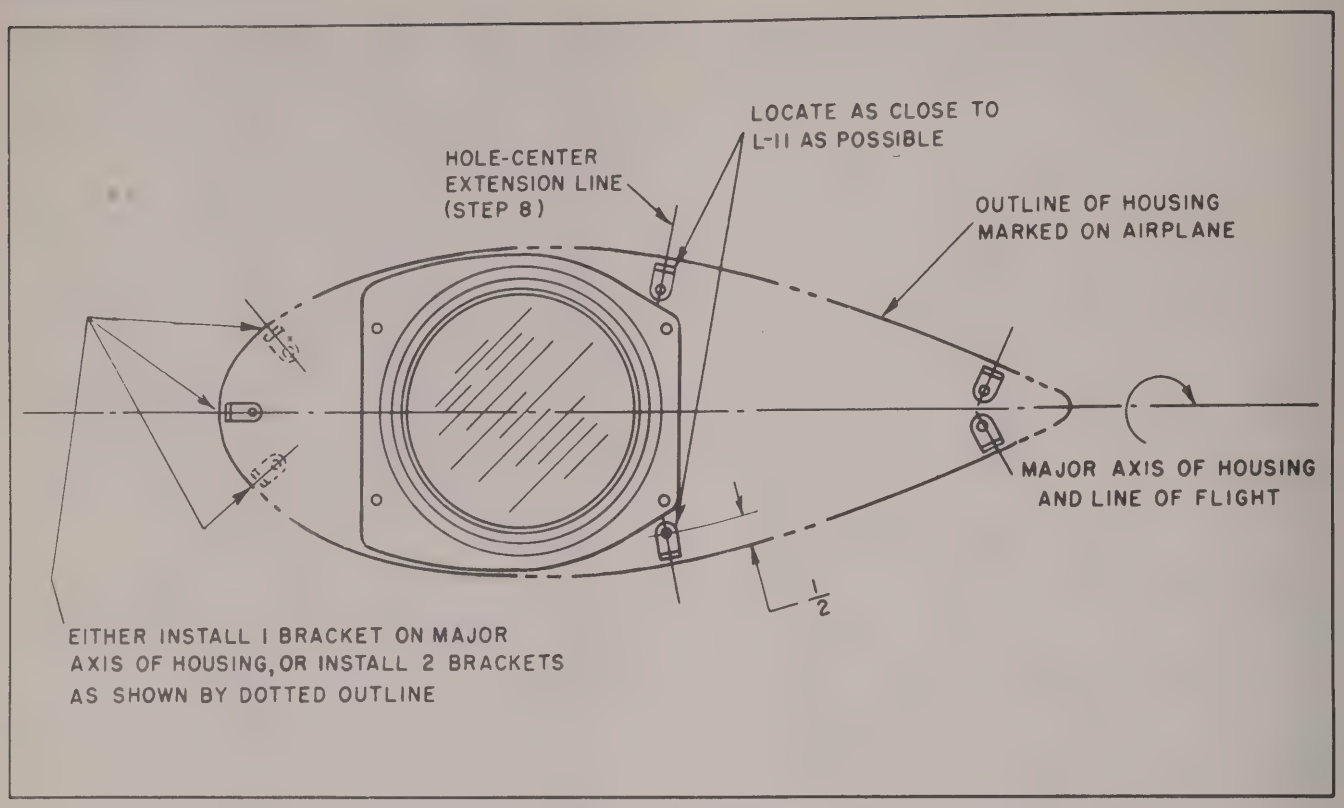


Figure 3–10. Location of Mounting Brackets for Housing ARC-17764

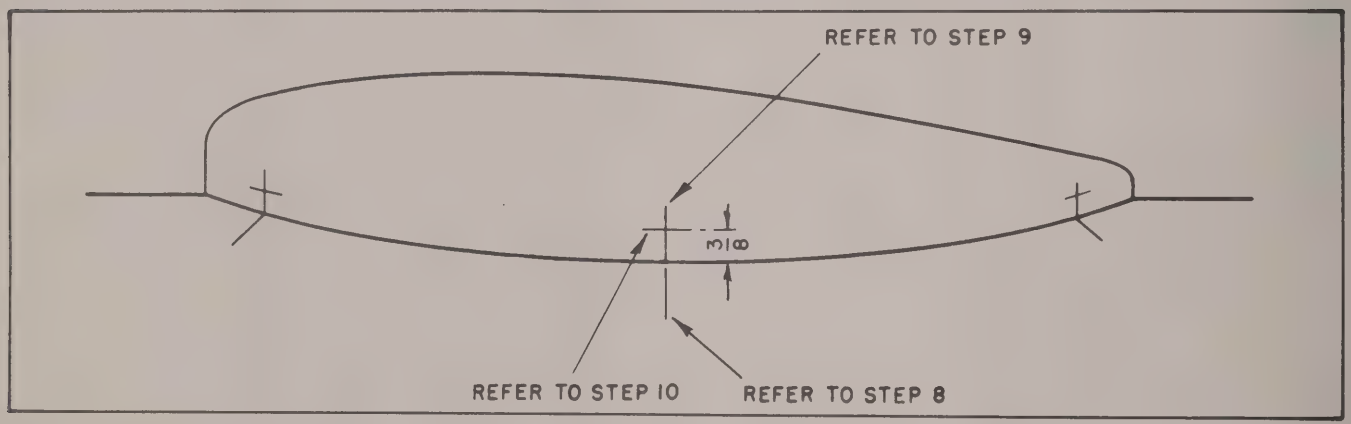


Figure 3–11. Location of Mounting Holes on Housing ARC-17764

3–21. MOISTURE DRAINAGE. If the loop is belly-mounted, drill two 3/16-inch holes in the housing for moisture drainage, one at the lowest point when the airplane is in normal position on the ground, and one on the center line about 1-1/2 inches from the rear.

3–22. INSTALLATION OF MECHANICAL LINKAGE. 3–23. A suitable length of Mechanical Linkage ARC-16158 is required between Control Unit Type C-59 and Receiver Type R-30 for remote tuning control of the R-30. Neither the assembly nor the detail parts are supplied as part of the Type 21, but the parts are available for field fabrication. (Assembly instructions are included with Mechanical Linkage Tool Type W-10. This tool facilitates the fabrication of the mechanical linkage, and is available as a separate item.) For proper installation, the relative positions of the C-59 frequency dial and the R-30 tuning capacitor must be adjusted. This is accomplished as follows:

Step 1. With the mechanical linkage interconnected between the R-30 and C-59, rotate the C-59 tuning crank counterclockwise as far as it will go, to bring the receiver tuning capacitor to its minimum-capacitance setting. Do not force beyond this point.

Step 2. Disconnect the mechanical linkage at either end.

Step 3. Turn the tuning crank until the reference line just to the right of the high-frequency end of the dial is aligned with the fiducial line.

Step 4. Reconnect the mechanical linkage.

Step 5. In order to minimize the effects of backlash in the cable, which sometimes occurs when the alignment is made at the capacitor stop, accurately tune in a station of known frequency in any one of the three bands, or use a signal source of known frequency and tune to the signal.

Step 6. Being careful not to disturb the receiver tuning of Step 5, again disconnect the mechanical linkage at either the receiver or control-unit end.

Step 7. Set the frequency dial to the *exact* reading of the signal source frequency.

Step 8. Taking extreme care not to disturb the setting of the frequency dial, or the receiver tuning, reconnect the mechanical linkage.

Step 9. Test the comparative tuning accuracy of the control unit and receiver by tuning in several stations of known frequency across the band, or by using another source of known frequencies. If the accuracy of the dial readings as compared to the signal frequencies differs by more than the width of one frequency-dial division line (approximately 1/32 inch), repeat Steps 5 through 8.

3–24. LOOP COMPENSATION PROCEDURES.

3–25. GENERAL. Due to the distortion of the radio field pattern caused by propellers, engines, wings, antennas, and other structural and electrical parts of the aircraft, it is necessary that the apparent direction of arrival of the radio signal be checked every 15 degrees with respect to the fore-and-aft axis of each particular type of aircraft. Provision is made to compensate for such errors, providing the error does not exceed ±25 degrees. Compensating screws are provided on the bottom of the loop for this purpose, and are available for adjustment from the interior of the airplane. The adjustments represent zero correction when set to a middle position (this is their position upon delivery). Loop compensation may be accomplished on the ground provided a suitable location can be found for this purpose. The location should be well clear of buildings, overhead or underground conductors, or other possible reflecting devices. The validity of such a location may be checked by selecting a second such location and verifying that similar results are obtained. For maximum accuracy, compensation should be accomplished on a frequency in the band where maximum accuracy is required. *In any case, ground compensation should be verified by a flight check,* preferably using the same signal source as that used for ground compensation. Observe the following precautions:

Do not attempt compensation during the period starting two hours before sunset and ending two hours after sunrise, because during this period sky waves from distant stations may introduce errors or bearing fluctuations.

In making flight checks or measurements, select a calm day in order to facilitate accurate readings of the indicator.

During flight, take the radio station bearings only when the aircraft is in level flight. Avoid disturbing the DG unnecessarily by making all turns uniform and gradual.

3–26. COMPENSATION OF LOOP ON GROUND. Loop compensation may be performed on the ground by tuning in a radio signal emanating from a known geographical location, and turning the aircraft as required to achieve the required relative heading. A flight check should be made following the adjustment, using either one of the flight procedures described in paragraphs 3–28 and 3–29 through 3–32. Compensate the loop as follows:

Step 1. Select a location as noted in paragraph 3–25.

Step 2. The bearing to the selected radio station must be accurately established, as well as the relative heading of the airplane. The angle may be determined by means of a stabilized compass system (such as the ARC Type CD-1), or by setting a transit or pelorus on top of the aircraft and sighting on a fixed object at least 1000 feet distant from the aircraft. The station selected should provide a strong, clear-channel signal, and normally should provide good, non-fluctuating bearing indications.

Step 3. Tune in the selected radio station, set the C-59 ANT-COMP switch to COMP, and turn the airplane to 0-degree relative heading.

Step 4. Adjust the 0-degree screw to make the IN-12 (or IN-13) read zero. (An extension cable permitting direct observation of the indicator while making this adjustment may prove extremely convenient.)

CAUTION

DO NOT FORCE SCREWS. In following the procedure of Steps 4, 5, 6, and 7, it may appear at first that the compensation available at a particular adjustment point is insufficient to make the IN-12 (or IN-13) read correctly. If this occurs, DO NOT FORCE the screw in question but proceed to set the other screws. When, as required by Step 8, the adjustment procedure is repeated, it will be found that sufficient compensation is available from all adjustment points.

Step 5. Turn the aircraft 15 degrees left, and adjust the red 15-degree adjustment screw to set the indicator at 15 degrees. (For top-mounted loops, adjust the black 15-degree screw.)

Step 6. Turn the aircraft another 30 degrees (45 degrees total with respect to the original zero indication) and adjust the red (for belly-mounted loop) or the black (for top-mounted loop) 45-degree adjustment screw to set the indicator at 45 degrees.

Step 7. Repeat this procedure for each of the following relative bearings: 75, 105, 135, 165, 180, 195, 225, 255, 285, 315, and 345 degrees, in that order, being sure the proper associated screw (red for belly-loop, black for top-loop) is adjusted in each case.

Step 8. Repeat Steps 5, 6, and 7 as often as necessary until satisfactory compensation is achieved.

Step 9. Move the aircraft to the alternate location on the field and check that the compensation adjustments made require no change.

Step 10. Flight-check the loop compensation adjustments by following either of the procedures described in paragraphs 3–28 and 3–29 through 3–32. In case any definite errors are noted, return to the ground location originally used. Repeat the compensation procedure, but this time make allowances for any discrepancies observed in the flight check. For example, if at the relative bearing of 30 degrees the indicator read 34 degrees in the air, adjust the compensation so as to achieve a 26-degree reading on the ground when the station is at 30 degrees relative bearing.

3–27. OBTAINING FLIGHT DATA FOR LOOP COMPENSATION. Two methods for obtaining the data necessary for loop compensation, or for verifying the compensation of the loop, are described in paragraphs 3–28 and 3–29 through 3–32. Either of these procedures may be used, after which the loop may be compensated, if required, as described in paragraphs 3–33 and 3–34. The compensation adjustment screws should be in their mid-position (zero correction) prior to making either of these flight procedures, unless the procedure is being used to flight-check the ground-compensation procedure of paragraph 3–26.

3–28. OBTAINING FLIGHT DATA FOR LOOP COMPENSATION, METHOD 1. The procedure outlined below requires a fairly linear ground reference landmark, such as a road or railroad tracks, directed toward a clear-channel radio station 25 to 100 miles distant. Possible distortion of the radio field may be caused by certain structures, such as power lines, steel towers, etc., on the route selected. To check whether such distortion exists, criss-cross the reference line at various angles, while maintaining fixed courses by means of the DG. If rapid changes in the bearing are noted as the line is crossed, distortion exists. This distortion should be eliminated either by selecting another landmark, or by flying at a higher altitude. Proceed as follows:

Step 1. With the aircraft in level flight, headed toward the radio station, fly the reference line at an altitude low enough for accurate determination of position and direction. Set the DG to zero if the DG is not slaved. If the aircraft has a slaved gyro, determine headings required to produce the desired relative headings. Using the IN-12 (or IN-13) VAR knob, set the azimuth scale zero to the zero-degree index. Turn the airplane to zero-degree relative bearing. Note and record the reading of the IN-12 (or IN-13) for this zero-degree heading of the aircraft. (See figure 3–12.)

Step 2. Fly a sufficient distance from the reference line so that it may again be crossed at a relative heading of 15 degrees. With the aircraft held in level flight on a relative heading of 15 degrees, note the indicator bearing when the reference line is crossed, and record this bearing on a form similar to that shown in figure 3–13. (An example of such a form on which the data has been recorded is shown in figure 3–14.)

Step 3. Fly sufficiently past the reference line so that the line is recrossed at a relative heading of 345 degrees with the plane in level flight. (See figure 3–12.) Note and record on the test data form the indicator bearing when the aircraft is over the reference line.

Step 4. Repeat Steps 2 and 3 for relative headings of 30 and 330 degrees.

Step 5. With the aircraft flying on a relative heading of 180 degrees from the radio station, check the DG reading when the heading of the aircraft coincides with the reference line. The DG reading should be within approximately 2 degrees of a 180-degree heading if all maneuvers have been made properly. If precession of the DG is noted when the 180-degree reference line course is checked, repeat the procedure, or check the DG. Normal creeping of a free DG (2 degrees or less over a period of 15 minutes) may be proportioned to each heading.

Step 6. With the aircraft on a 180-degree relative heading away from the radio station, follow a procedure similar to that outlined previously and obtain indicator readings for relative headings of 195, 165, 210, and 150 degrees. (See figure 3–12.) Then, turn the aircraft to head toward the radio station along the reference line, establishing a zero-degree relative heading with respect to the reference line.

Step 7. Continue to fly to and from the radio station, criss-crossing the reference line, as shown in figure 3–12, until indicator readings for every 15-degree change in the heading of the aircraft have been recorded. This recorded data is to be used for compensating the loop.

Note

The procedure outlined in Steps 1 through 7 may be made over a single point, such as a road intersection, providing the bearing point to the radio station is known. Fly a series of figure eights, always crossing the reference point on a 15-degree change in relative heading from the previous course. Note and record the indicator reading when the aircraft is over the reference point.

3–29. OBTAINING FLIGHT DATA FOR LOOP COMPENSATION, METHOD 2.

3–30. OPERATING CONSIDERATIONS. The procedure outlined in paragraph 3–32 requires making two 360-degree flight turns in opposing directions, some distance from a radio station. A landmark, such as a crossroad or a building, is used for a ground reference point from which each circle is started. Disregarding errors introduced by flight conditions or observation procedures, the accuracy of this procedure depends on the distance of the reference point from the radio station and the diameter of the two circles. The ground reference point should be as far as possible from the radio station, but still at a distance where reliable bearing indications can be obtained. The diameter of each circle should be equal and as small as possible, yet large enough so that the flying time during each chord of the circle is sufficient to permit obtaining a reliable reading. As a general recommendation, it is suggested that the distance between the ground reference point and the radio station be at least 60 miles, and that each circle have a maximum diameter of 9 miles.

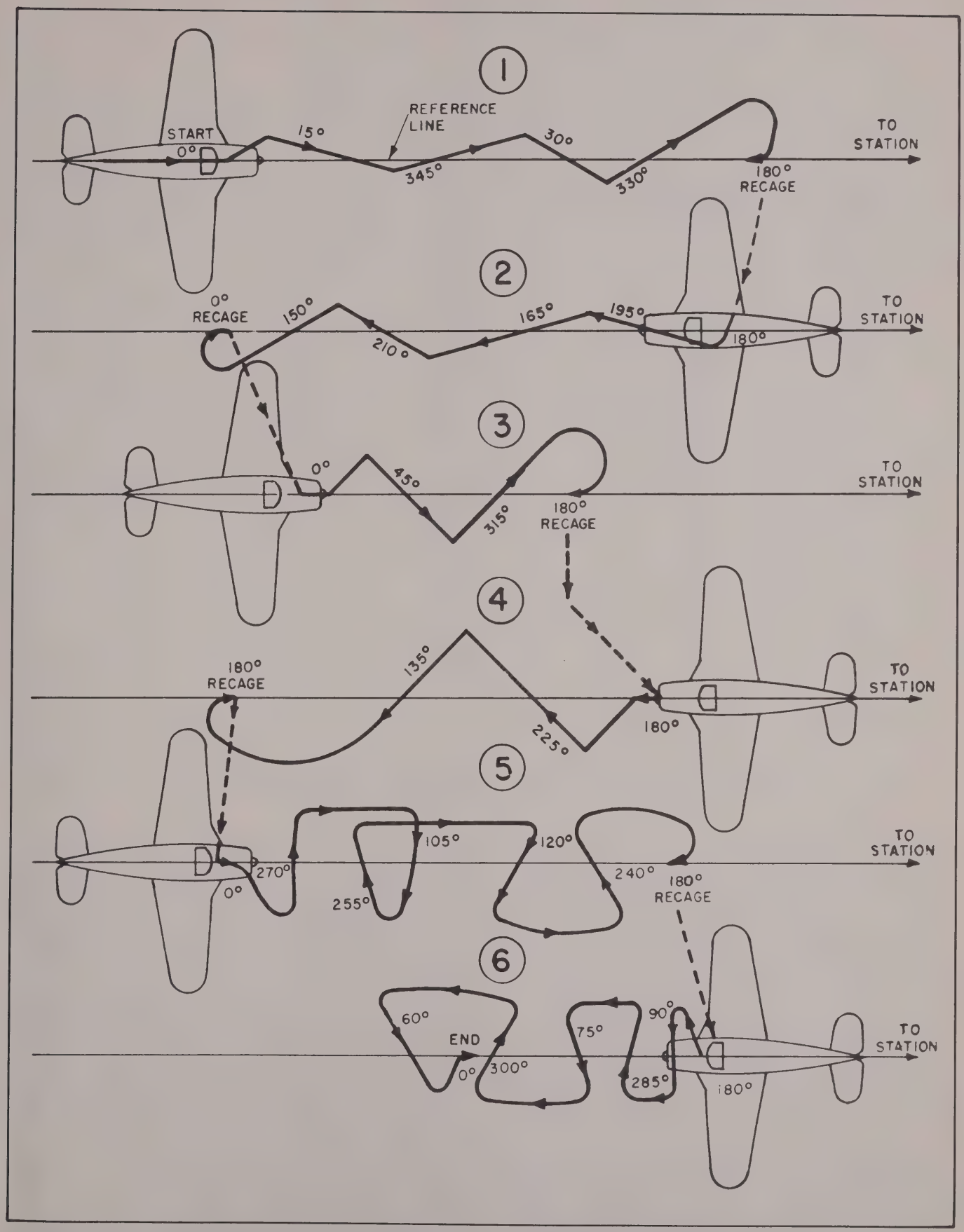


Figure 3—12. Procedure for Obtaining Flight Data for Loop Compensation, Flying Ground Reference Line

FLIGHT DATA FOR LOOP COMPENSATION

Station Used _____ Frequency _____
Pilot _____ Recorder _____
Aircraft Type _____ Aircraft No. _____

	FLIGHT DATA		
	Column 1	Column 2	Column 3
	Relative Heading	Plane-to-Station Bearing	Indicator Reading
*	0	0	
	15	345	
	345	15	
	30	330	
	330	30	
†	180	180	
	195	165	
	165	195	
	210	150	
	150	210	
*	45	315	
	315	45	
†	225	135	
	135	225	
*	270	90	
	105	255	
	255	105	
	120	240	
	240	120	
†	90	270	
	285	75	
	75	285	
	300	60	
	60	300	

LOOP COMPENSATION DATA	
Column 4	Column 5
Loop Azimuth Scale Reading	Corrected Indicator Reading
0	
15	
45	
75	
105	
135	
165	
180	
195	
225	
255	
285	
315	
345	

* Cage DG 0 degrees if free DG is used.
† Recage DG 180 degrees if free DG is used.

Figure 3–13. Form for Recording Flight Data for Loop Compensation

3–31. PRELIMINARY PROCEDURE. Before the actual flight procedure is begun, it is necessary to coincide the zero-degree bearing of Indicator Type IN-12 (or Indicator Type IN-13) with the zero-degree heading of the aircraft. This may be done using the ground and air procedures outlined in paragraph 3–26 and Step 1 of paragraph 3–28, or in the air alone by the following method:

Step 1. Head the aircraft directly toward a radio station whose transmitting tower is clearly visible.

Step 2. Tune Receiver Type R-30 to the station frequency. Set the IN-12 (or IN-13) azimuth scale zero to the zero index by means of the VAR knob.

Step 3. Using a cross-hair sight which has been aligned accurately with the fore-and-aft axis of the aircraft, align the axis of the aircraft with the station antenna tower, as accurately as possible. Alternatively, if a cross-hair sight is not available, the aircraft heading and the tower may be aligned by an observer stationing himself as far aft as possible, with a clear line-of-sight through the vertical center of the windshield, and sighting along the center-line of the aircraft through the center of the windshield. Heading checks made directly from the cockpit are not reliable because parallax errors may result.

Step 4. With the aircraft held in level flight, and headed directly toward the station tower, note the IN-12 (or IN-13) reading. To confirm the reading obtained, approach the station tower from the opposite direction and check that the indicator reading is the same. Record the indicator reading obtained for the zero-degree heading of the aircraft.

3–32. FLIGHT PROCEDURE. Having correlated the zero-degree indicator bearing and the zero-degree aircraft heading, the flight procedure may be made. This procedure is illustrated in figure 3–15. The principle

FLIGHT DATA FOR LOOP COMPENSATION

Station Used _____ Frequency _____
Pilot _____ Recorder _____
Aircraft Type _____ Aircraft No. _____

	FLIGHT DATA		
	Column 1	Column 2	Column 3
	Relative Heading	Plane-to-Station Bearing	Indicator Reading
*	0	0	359
	15	345	350
	345	15	7
	30	330	339
	330	30	15
†	180	180	179
	195	165	169
	165	195	186
	210	150	158
	150	210	195
*	45	315	326
	315	45	26
†	225	135	146
	135	225	205
*	270	90	88
	105	255	241
	255	105	112
	120	240	220
	240	120	131
†	90	270	269
	285	75	61
	75	285	293
	300	60	41
	60	300	311

LOOP COMPENSATION DATA	
Column 4	Column 5
Loop Azimuth Scale Reading	Corrected Indicator Reading
0	1
15	30
45	63
75	83
105	100
135	123
165	159
180	181
195	210
225	243
255	263
285	279
315	303
345	337

* Cage DG 0 degrees if free DG is used.
† Recage DG 180 degrees if free DG is used.

Figure 3–14. Example of Recorded Flight Data for Loop Compensation

of this procedure is to obtain indicator readings for every 15-degree change in DG heading of the aircraft during each of the 360-degree turns. To approximate a circle as closely as possible, the flying time and speed of each 15-degree course should be very nearly equal. After each turn has been completed, an indicator reading relative to a given DG reading will be obtained for each turn. These indicator readings are averaged, the result being used for loop compensation adjustments. Proceed as follows:

Step 1. Select a ground reference point which is not less than 60 miles from the radio station to be used. Approach the reference point so that it is between the aircraft and the station. Orient the aircraft for a zero-degree bearing as indicated on the IN-12 (or IN-13). If the preliminary procedure outlined in paragraph 3–31 has established that the zero heading of the aircraft does not coincide with the zero bearing of the station, within ±2 degrees, fly the aircraft on the heading that corresponds to the zero-degree station bearing obtained in the preliminary procedure.

Step 2. With the aircraft held in steady, level flight on a heading of zero degrees with respect to the station, set the DG to zero. (If a slaving DG is installed in the aircraft, determine the proper relative heading.) Maintain the aircraft heading, and when the plane is over the ground reference point, release the DG caging knob of a free DG, or note the proper relative heading of the slaved gyro. The IN-12 (or IN-13) should read zero, or the same comparative reading obtained in the preliminary procedure.

Step 3. Turn the aircraft smoothly and evenly to the right for a relative heading of 15 degrees. With the aircraft leveled out on this heading for not more than 25 seconds, note and record the station bearing on a form similar to that shown in figure 3–13.

PROCEDURE:

1. ESTABLISH HEADING.
2. READ IN-12 (OR IN-13) BEARING.
3. CHANGE DG HEADING 15 DEGREES AND REPEAT.(ALLOW EQUIVALENT TIME FOR EACH HEADING SO THAT DIAMETERS OF TURNS ARE EQUAL.)

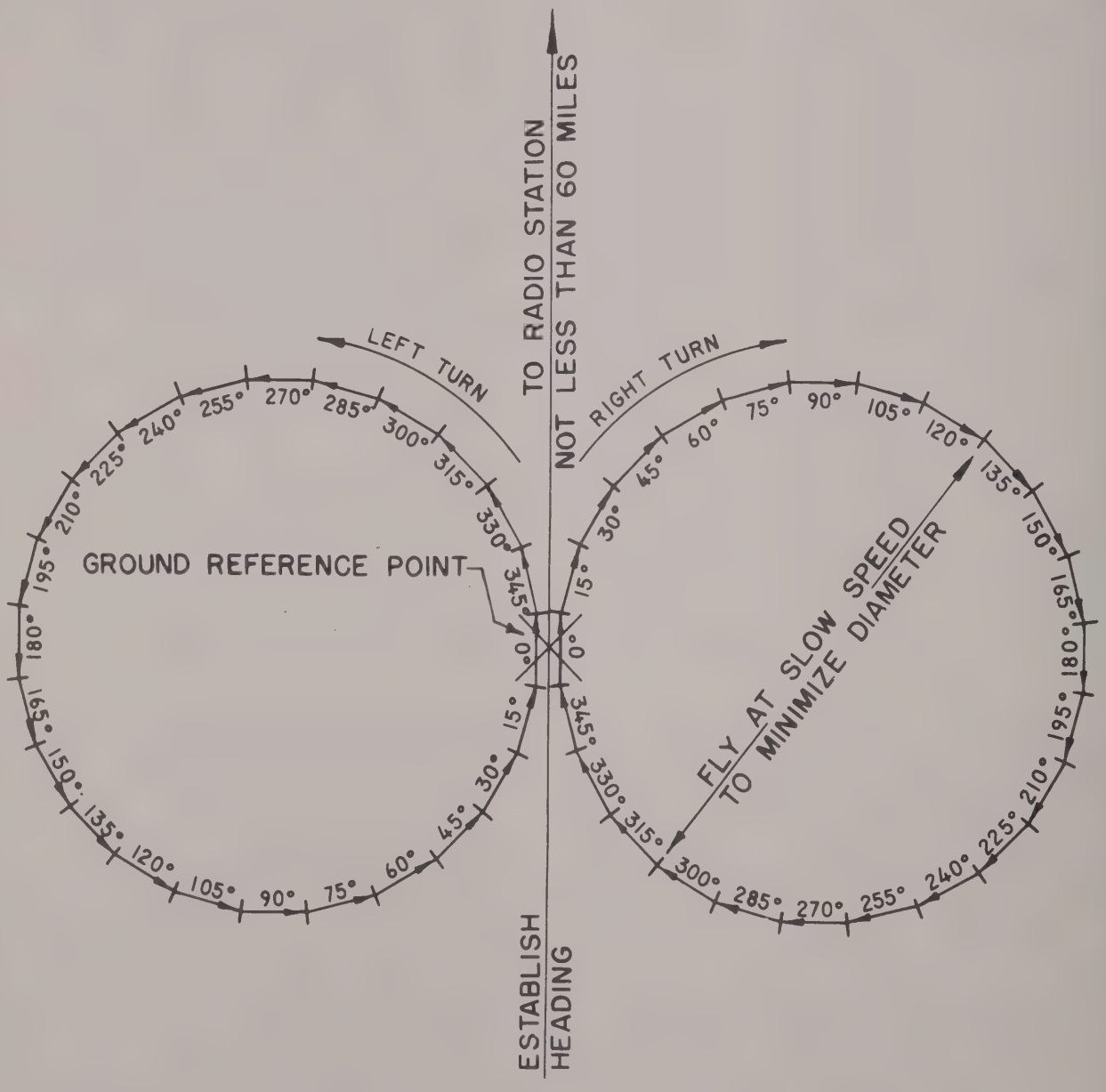

TO RADIO STATION
NOT LESS THAN 60 MILES
LEFT TURN
RIGHT TURN
GROUND REFERENCE POINT
FLY AT SLOW SPEED TO MINIMIZE DIAMETER
ESTABLISH HEADING
0° 15° 30° 45° 60° 75° 90° 105° 120° 135° 150° 165° 180° 195° 210° 225° 240° 255° 270° 285° 300° 315° 330° 345°

Figure 3—15. Procedure for Obtaining Flight Data for Loop Compensation, Flying Two 360-Degree Turns

Step 4. Turn the aircraft for a relative heading of 30 degrees. After level flight has been assumed, note and record the indicator reading.

Step 5. Follow a similar procedure as outlined in previous Steps 3 and 4 for each 15-degree increase in relative heading of the aircraft, until the circle-turn is completed. Record the IN-12 (or IN-13) readings for each heading. If the turn has been executed properly, the aircraft should be over the reference point at the end of the last 15-degree turn. Turn the aircraft for a zero-degree indicator bearing. The aircraft should now be headed directly toward the transmitter in line with the original starting line. Note and record the relative heading for this aircraft heading. This reading should agree with its original setting within 2 to 3 degrees, if all turns have been made properly.

Step 6. With the aircraft over the ground reference point and headed directly toward the transmitter, as indicated by the IN-12 (or IN-13), check that the DG indication is in agreement with the original DG setting. (If not, make a zero-degree reference check, as outlined in Steps 1 and 2 of this procedure.)

Step 7. Start the second 360-degree turn by turning the aircraft to the left for a 345-degree relative heading. When the aircraft is in steady, level flight on this heading, note and record the indicator reading.

Step 8. Continue the circle-turn, until completed, decreasing the relative heading in 15-degree intervals. Keep the diameter of this left turn as equivalent as possible to the right turn made previously. Record the indicator readings for each 15-degree change.

Step 9. Average the right-turn and left-turn indicator readings for each similar DG heading. Record these averages for use in making the loop compensation adjustments.

3—33. COMPENSATION DATA CURVE. After the in-flight compensation data has been acquired, the data may be plotted and the resulting curve used for determining the loop compensation adjustments. Proceed as follows:

Step 1. Using figure 3—16, plot the indicated bearing (column 3) against the corresponding plane-to-radio station bearing (column 2). An example of a resultant curve is shown in figure 3—17. (This data may be plotted directly on figure 3—16. A spare form is included in figure 6—22.)

Step 2. Lay a straight edge parallel to the sloping dotted line and through the data point of column 3 on the vertical scale, and draw a fine line. (See figure 3—17.) The point at which this line intersects the solid 15-degree line is the plot point. (The example shown in figure 3—17 indicates that for a true bearing of 15 degrees, the indicated bearing is 7 degrees.)

Step 3. Repeat Step 2 for each of the remaining 15-degree positions.

Step 4. Connect the plotted points to form the compensation data curve.

Step 5. Determine the corrected indicator reading values for column 5 of figure 3—13 (see figure 3—14 for example) from the resulting curve as follows:

Step 5A. Draw fine lines parallel to the solid lines at the intersections of the plotted curve and the dotted lines corresponding to the degree values given in column 4 (see figure 3—17).

Step 5B. In column 5, record the values for the points of intersection as read on the vertical graduations beside the 15-degree dotted line values in column 4 (see figure 3—17). For example: To determine the corrected indicator bearing for a loop position of 45 degrees (column 4), lay the straight edge parallel to the solid line and draw a fine line through the intersection of the dotted 45-degree line and the curve (see figure 3—17). This line passes through the vertical graduations at 63 degrees. This value is recorded in column 5. Similiarly, a bearing of 105 degrees from column 4 gives a bearing of 100 degrees for column 5.

3—34. ADJUSTMENT OF LOOP COMPENSATION SCREWS. Adjustment of the loop compensation screws may be made with the loop installed on the airplane; or, if desirable, the loop may be removed from the airplane and installed in a bench set-up of ARC Type 21 equipment. Using the data recorded in columns 4 and 5 of figure 3—13, proceed as follows:

Step 1. Determine which loop azimuth scale is to be used. The red scale is for bottom mounting, while the black scale is for top mounting.

Step 2. Turn on the equipment. (Do not run the engines.) Set the ANT-COMP switch to the ANT position, and set the VOL control at minimum.

Step 3. Turn the loop with the COMP TEST switch until the loop fiducial is at zero degrees, and turn the zero-degree adjustment screw until the IN-12 (or IN-13) reads the computed value in column 5 of figure 3—13.

Step 4. Turn the loop with the COMP TEST switch to 15 degrees, and adjust the red or black (as applicable) 15-degree adjustment screw until the IN-12 (or IN-13) reads the comparative computed value of column 5.

Step 5. Continue the adjustments for each of the settings listed in column 4 of figure 3—13, adjusting the applicable compensator screw for each setting. Repeat these adjustments, and those of Steps 3 and 4, until satisfactory compensation has been achieved.

Step 6. Ground- and flight-test the equipment before installing the loop housing (refer to paragraphs 3—17 through 3—21) in case additional adjustment may be required.

LOOP COMPENSATION DATA CURVE

Date _____ By _____

Aircraft Type and No. _____

Station _____ Frequency _____

Ground Reference Line _____

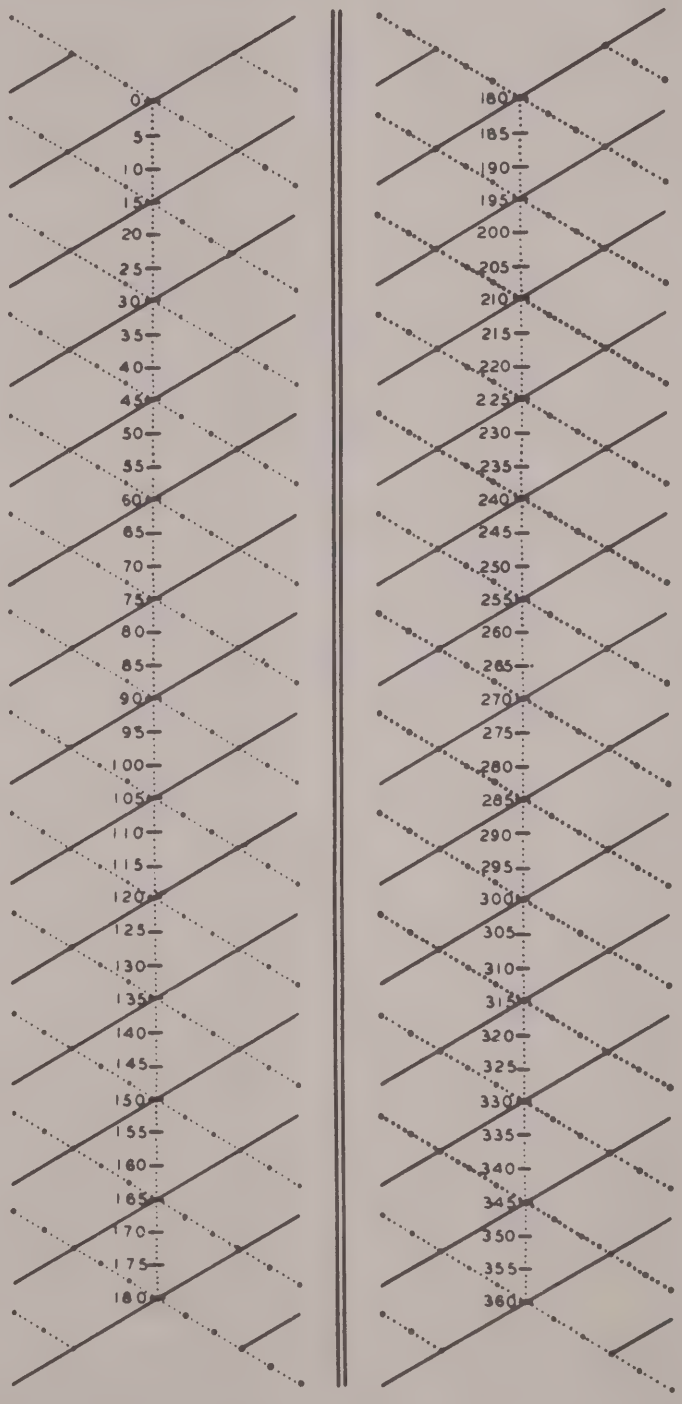


Figure 3–16. Form for Plotting Loop Compensation Data Curve

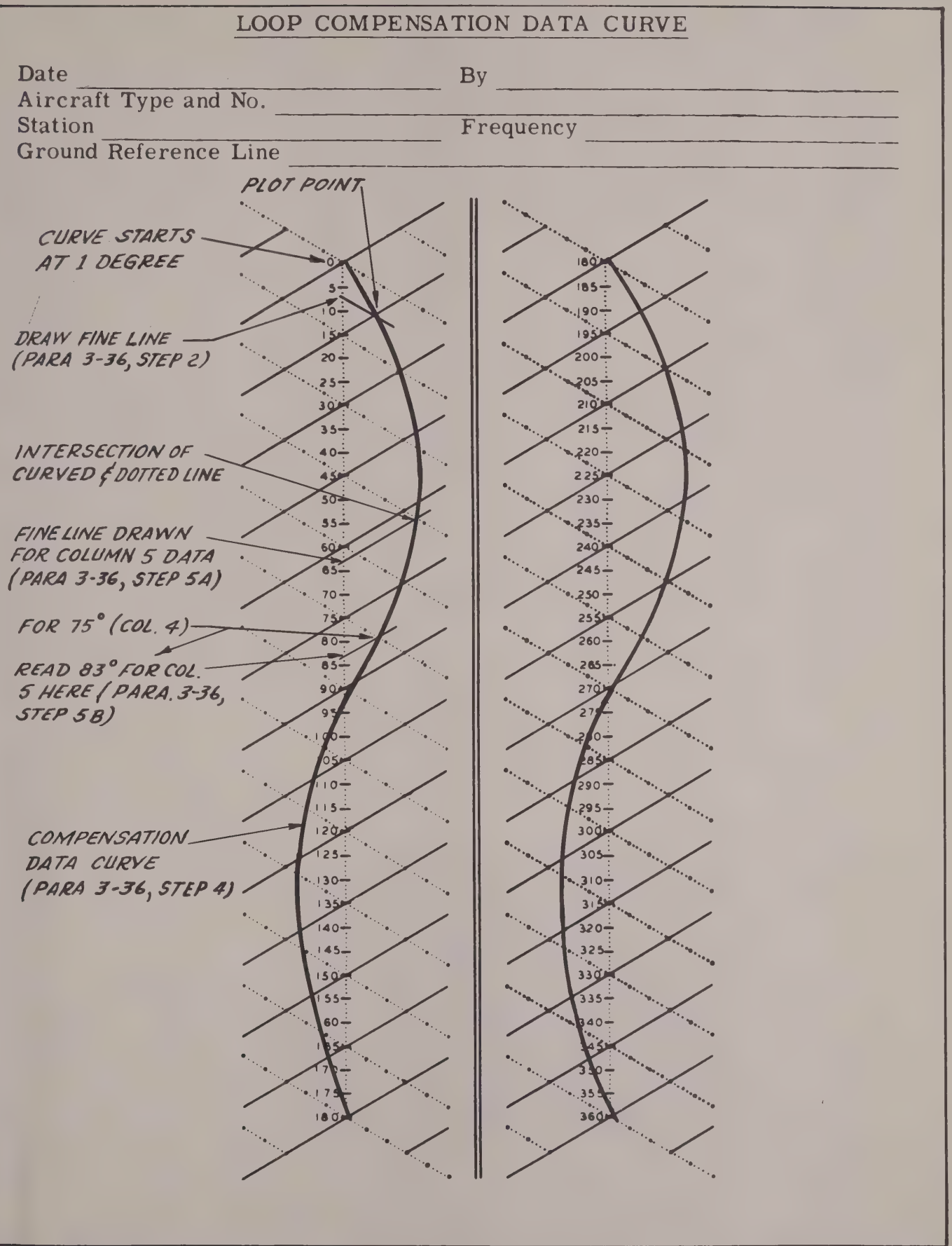

LOOP COMPENSATION DATA CURVE
Date
By
Aircraft Type and No.
Station
Frequency
Ground Reference Line
PLOT POINT
CURVE STARTS AT 1 DEGREE
DRAW FINE LINE (PARA 3-36, STEP 2)
INTERSECTION OF CURVED & DOTTED LINE
FINE LINE DRAWN FOR COLUMN 5 DATA (PARA 3-36, STEP 5A)
FOR 75° (COL. 4)
READ 83° FOR COL. 5 HERE (PARA. 3-36, STEP 5B)
COMPENSATION DATA CURVE (PARA 3-36, STEP 4)

Figure 3—17. Example of Loop Compensation Curve

SECTION IV
OPERATION

4–1. OPERATING CONTROLS.

4–2. The following controls and meter for the ARC Type 21 ADF are located on the C-59 control unit (see figure 4–1):

Tuning crank
Band switch (BAND)
Function switch (ANT-COMP)
Test switch (COMP TEST)
Volume control (VOL)
Tuning meter

4–3. OPERATION OF ARC TYPE 21 ADF, GENERAL PROCEDURE.

Step 1. Turn VOL control full clockwise.

Step 2. Set ANT-COMP switch in COMP position.

Step 3. Turn the BAND switch to the frequency band desired.

Step 4. Turn the tuning crank to the desired frequency, and tune for maximum tuning meter reading by slowly rotating the tuning crank in the vicinity of the desired frequency.

Step 5. Reduce volume by turning the VOL control counterclockwise until the desired audio level is obtained.

Step 6. Check station identification to be certain that the desired station is being received. If the signal strength is too weak for easy identification in the COMP position, the signal-to-noise ratio may generally be improved by temporarily switching to the ANT position for identification purposes.

Step 7. Turn the VAR knob of the IN-12 or IN-13 indicator so that the azimuth scale zero is on the top index mark. The indicator pointer will then show the bearing of the received station *relative* to the aircraft's heading. For example, if the indicator reads "0," the station is dead ahead; if it reads "90," the station is to the right side of the aircraft.

Step 8. To ascertain that the bearing read on the indicator is a reliable one, move the COMP TEST switch to the right and observe that the pointer rotates clockwise. After the pointer has travelled 10 or 20 degrees, release the switch and note the action of the indicator pointer. If the operation is normal and a reliable signal is received, the pointer will immediately return to the original reading. This procedure may be repeated, if desired, by moving the switch to the left, in which case the pointer will rotate counterclockwise until the switch is released.

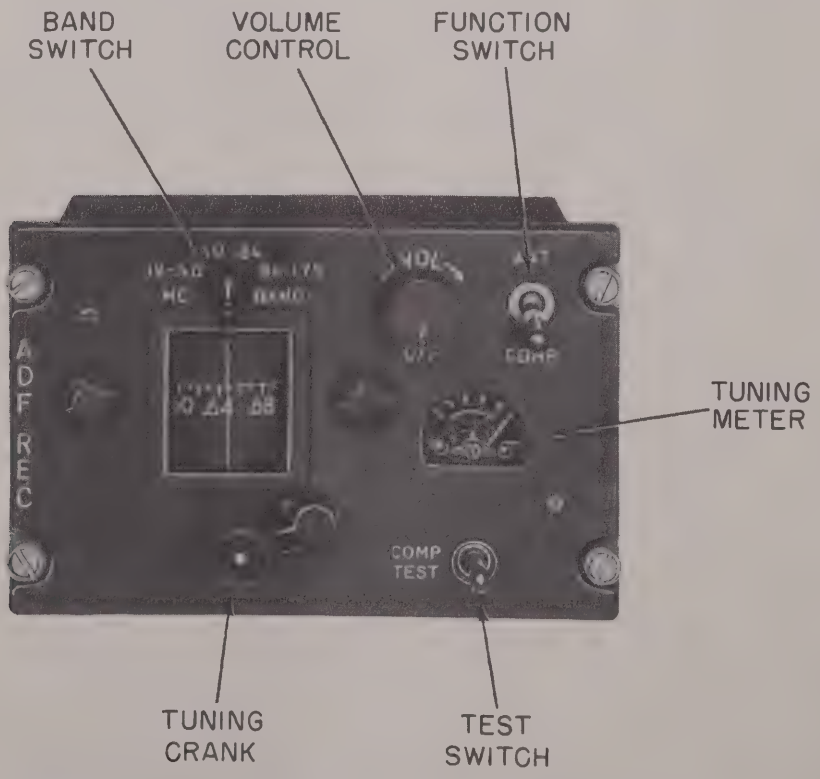


Figure 4–1. Control Unit Type C-59, Front Panel View

4–4. ADF HOMING OPERATION.

4–5. The equipment may be operated as a homing system by following the procedure of paragraph 4–3 and holding the aircraft's course so that the pointer of the IN-12 or IN-13 indicator reads "0." A right deflection of the indicator pointer (0 to 180 degrees) requires a right turn to bring the indicator to a "0" reading and conversely, a left indicator reading requires a left turn.

4–6. The procedure of paragraph 4–5 will bring the aircraft over the station but does not make provision for drift due to cross wind. The flight will therefore be a curved path according to the direction and magnitude of drift.

4–7. If the direction and magnitude of cross wind is known, the heading can be modified accordingly. For example, if the wind is coming from the left side of the aircraft requiring a 10-degree "crab" angle to stay on course, the indicator should be held to 10 degrees instead of 0 degrees. As an alternative procedure, the VAR knob of the IN-12 or IN-13 may be set so that the 350-degree mark (—10 degrees) is on the top index mark, and the pointer may then be held to the "0" reading of the azimuth scale.

4–8. If the cross-wind effect is not known, it may be determined by observing the change in magnetic heading while homing with the ADF. If the magnetic heading increases, the wind is from the right and the IN-12 (or IN-13) indicator should be held to the left (towards 350 degrees) of the "0" reading of the azimuth scale. This procedure should be continued until the rate of change in magnetic heading is minimized.

4–9. In any case, even with improper wind correction, the homing procedure will ultimately bring the aircraft over the station being received.

4–10. ADF MAGNETIC BEARING DETERMINATION.

4–11. The IN-12 or IN-13 indicator may be used to read the *magnetic bearing* of a received station directly against the azimuth scale by proper setting of the azimuth scale with the VAR knob. In this case, the VAR knob is set so that the azimuth scale reading against the top index mark is the magnetic heading of the aircraft. The IN-12 (or IN-13) pointer read against the azimuth scale is then the *magnetic bearing* of the received station.

4–12. ADF TRUE BEARING DETERMINATION.

4–13. The IN-12 or IN-13 indicator may be used to read the *true bearing* of a received station directly against the azimuth scale. This is done by setting the VAR knob of the indicator so that the azimuth scale reading against the top index mark is the sum of the magnetic heading of the aircraft, and the local magnetic variation. For this addition, a west variation is taken as negative and an east variation as positive. For example: in a region where the variation is 10 degrees west, a magnetic heading of 80 degrees corresponds to a true heading of 70 degrees; so that if 70 degrees on the azimuth scale is brought opposite the top index by rotation of the VAR knob, the indicator pointer will then show the true bearing of the station. The VAR knob is marked with east-west arrows to indicate the required direction-of-correction of the magnetic heading to transform it to true heading.

4–14. POSITION DETERMINATION.

Step 1. Select three stations which are located at approximately equal intervals about the aircraft's position.

Step 2. Using the true bearing procedure, outlined in paragraph 4–13, record the bearing of each station. The three readings should be taken as quickly as possible to minimize error.

Step 3. The bearings recorded should be the station-to-aircraft bearings with reference to true north, as read at the tail end of the pointer. Project lines, on an area chart showing the location of these three stations, from each station toward the location of the aircraft. The aircraft position is at the intersection of these three lines, or, if they do not intersect at a point, is near the center of the triangle formed by the intersection of the three lines. A fix on two stations only will also give position, but lacks the check obtained from utilizing a third station.

4–15. OPERATION OF ARC TYPE 21 AS A LOW-FREQUENCY RANGE RECEIVER.

4–16. When the ANT-COMP switch of the C-59 is in the ANT position, the VOL control functions as an r-f sensitivity control. As described in paragraph 2–20, when the VOL control is adjusted to a normal listening level during ANT operation, the avc is inactive due to the avc delay. This, plus the sensitivity and selectivity of the R-30 receiver, makes the ARC Type 21 ADF very suitable for use as a four-course range receiver. To operate the ARC Type 21 ADF for receiving four-course radio ranges, proceed as follows:

Step 1. Set the ANT-COMP switch in ANT position.

Step 2. Turn the BAND switch to the frequency band desired.

Step 3. Turn the tuning crank to the desired frequency, and tune for optimum audio intelligibility.

Step 4. Adjust the VOL control for desired headset volume.

Step 5. Check station identification to be certain that the desired station is being received.

Note

The receiver should always be operated with the VOL control backed off to a comfortable audio level when operating as a range receiver, because course broadening may result at high audio levels. Note that in ANT operation the audio output level is adjusted by manually varying the r-f gain of the receiver, rather than by varying the audio frequency gain, as is the case in COMP operation. This method is used so that the incoming signal level may be kept below the range of avc action, thereby providing an indication of relative signal strength. The control circuit of the ANT-COMP switch automatically switches the action of the VOL control to perform the functions described.

SECTION V
MAINTENANCE

5–1. GENERAL.

5–2. This section includes replacement and alignment procedures, and other maintenance data. The performance of the individual components may be checked by substituting a similar component known to be good, and making a comparative test. If the receiver is inoperative, or its performance is not up to specifications, tube replacement (or component substitution) may be required. Localization of trouble can be facilitated by an understanding of the theory of operation of the equipment, as described in Section II; by reference to the schematic diagrams contained in Section VI; and by reference to the voltage measurements (table 5–1), the resistance measurements (table 5–2), and the typical stage gain measurements (table 5–3).

5–3. All electron tubes and component parts, except certain parts in the r-f units, are accessible without disassembly. Access to the parts on the IF-AF terminal board is provided by the hinge-mounting of the terminal board. To expose these parts for servicing, remove the conical stud and adjacent screw on the front panel, which secure the hinged side of the front panel, and the two screws passing through the deck, adjacent to the ganged tuning capacitor, which are tapped into the angle support for the terminal board. To reach one of these screws, it is necessary to set the tuning capacitor to its fully meshed position.

5–4. REPLACEMENT OF TUBES.

5–5. The tubes installed in Receiver Type R-30 are all subminiature types. In place of pin connections, these tubes use flexible leads which are soldered directly to a terminal point. If any of these tubes are replaced, the new tubes should be oriented and their leads routed as nearly like the original installation as possible. The locations of all tubes are shown in figure 5–1. Wiring diagrams of the tubes showing proper orientation and lead routing are shown in figures 5–2 through 5–7. When replacing a tube, do not precut the leads before installation, keep the spacing between leads at least 1/16-inch, and use a minimum amount of solder.

5–6. REMOVAL AND REPLACEMENT OF R-F ASSEMBLIES.

5–7. REMOVAL OF R-F ASSEMBLIES. In general, the procedure for removing any of the r-f units is as follows:

Note

It is advisable to fully engage the ganged tuning capacitor (maximum capacity) prior to removal of an r-f unit, to prevent accidental damage to the rotor blades.

Step 1. Unsolder the five wires from the terminal board in the lower left of the band switch assembly (under the cover), remove the four screws securing the assembly to the front panel, and withdraw the assembly from the receiver.

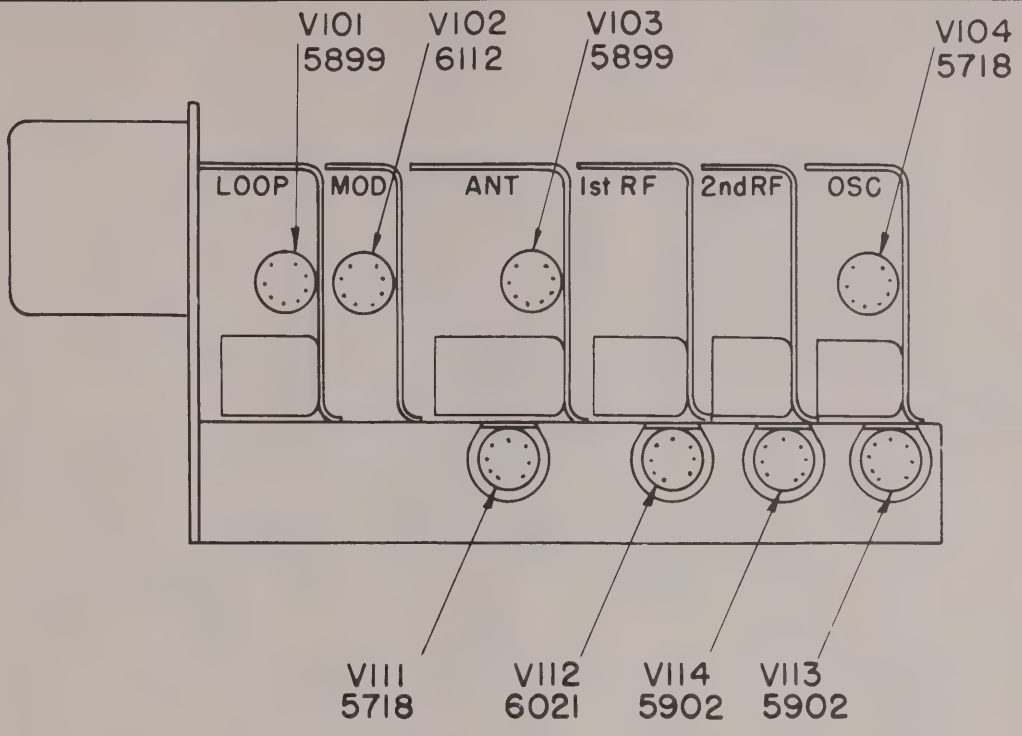
Step 2. Unsolder the connections from the unit to be removed and the lead from the ganged tuning capacitor stator, and remove the four screws (two on top and two below deck) which hold the unit in place. In the case of the LOOP unit it is also necessary to unsolder the connections to the loop cable, at the receptacle J101, and pull these leads up through the hole in the chassis.

Step 3. Slide the unit sideways to remove.

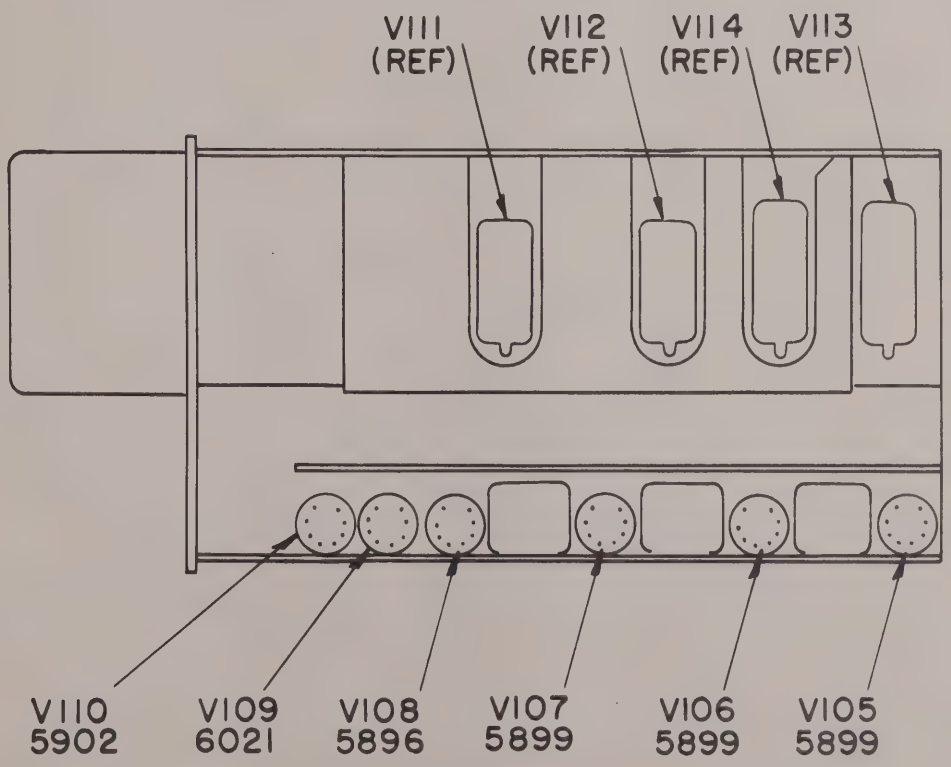
5–8. As an alternative procedure for removing the OSC and 2nd RF units, which are located at the rear, it is possible to leave the band switch assembly in place, and remove the unit desired by pulling it off the shaft toward the rear of the receiver. The OSC unit may be removed alone, but to remove the 2nd RF unit it is first necessary to remove the OSC unit.

5–9. REPLACEMENT OF R-F ASSEMBLIES. To replace any of the r-f assemblies, reverse the procedures outlined previously for removal of a unit. Observe the following precautions during such replacement. Always carefully inspect the front and rear wafer switch contacts before replacement of the unit. Before engagaing the long switch shaft in any switch rotor, be sure that the rotor is not rotated 180 degrees from its proper position. The proper position is where all switch rotor notches are on the same side of the flatted shaft, and in general agreement with (30 degrees counterclockwise from) the notch in the rotor of the band-selector switch wafer.

5–10. If a unit has been installed with the rotor oriented improperly, it is not necessary to remove it for realignment of the rotor. Simply, push the shaft through the properly aligned rotors, turn the shaft (by rotating the entire band switch assembly) until the previously engaged rotors agree with the one that is improperly oriented, engage this rotor, and return the shaft to the original angle to engage the remaining rotors.



RIGHT SIDE VIEW



BOTTOM VIEW

Figure 5–1. Location of Electron Tubes in Receiver Type R-30

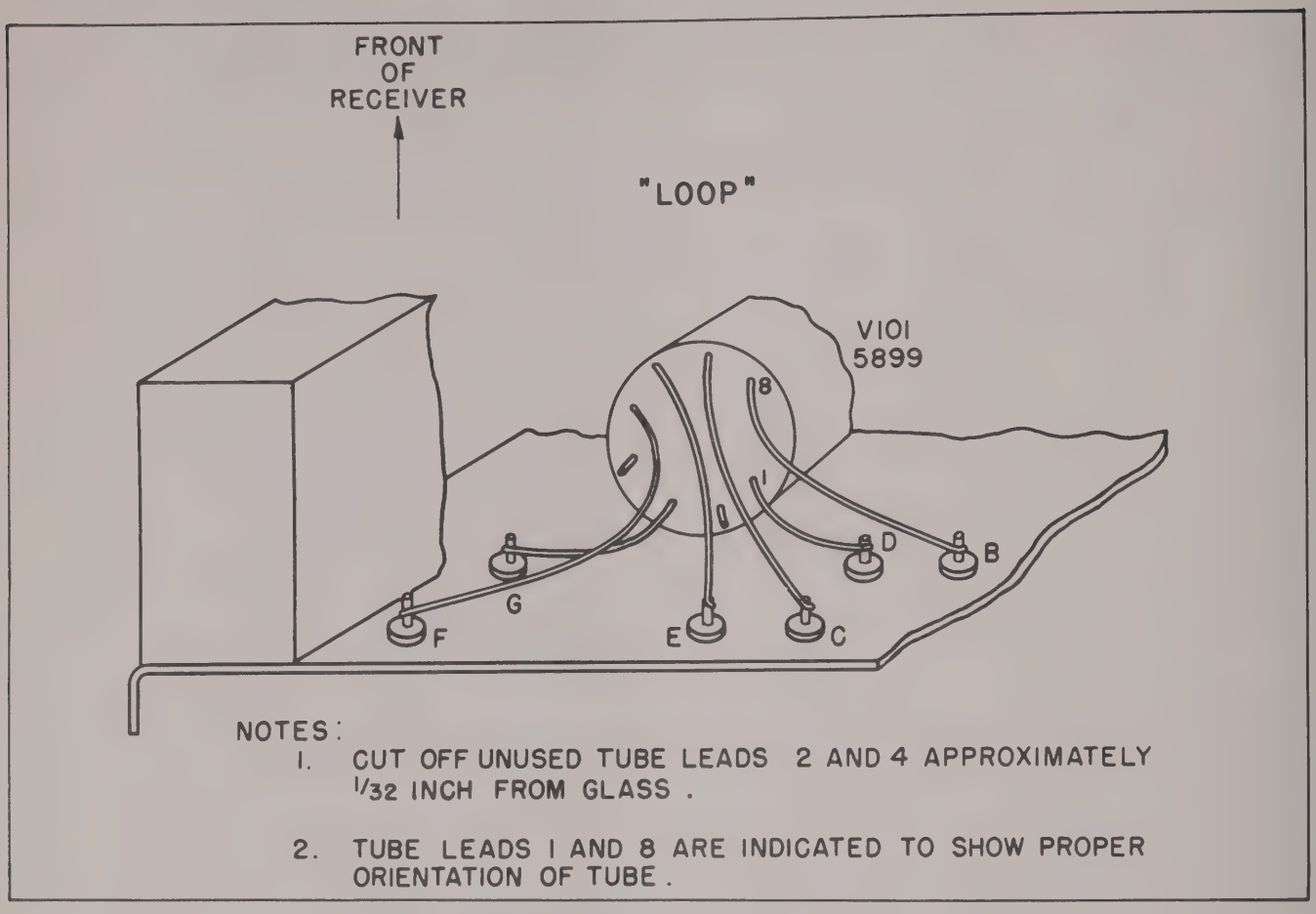


Figure 5–2. Wiring of V101

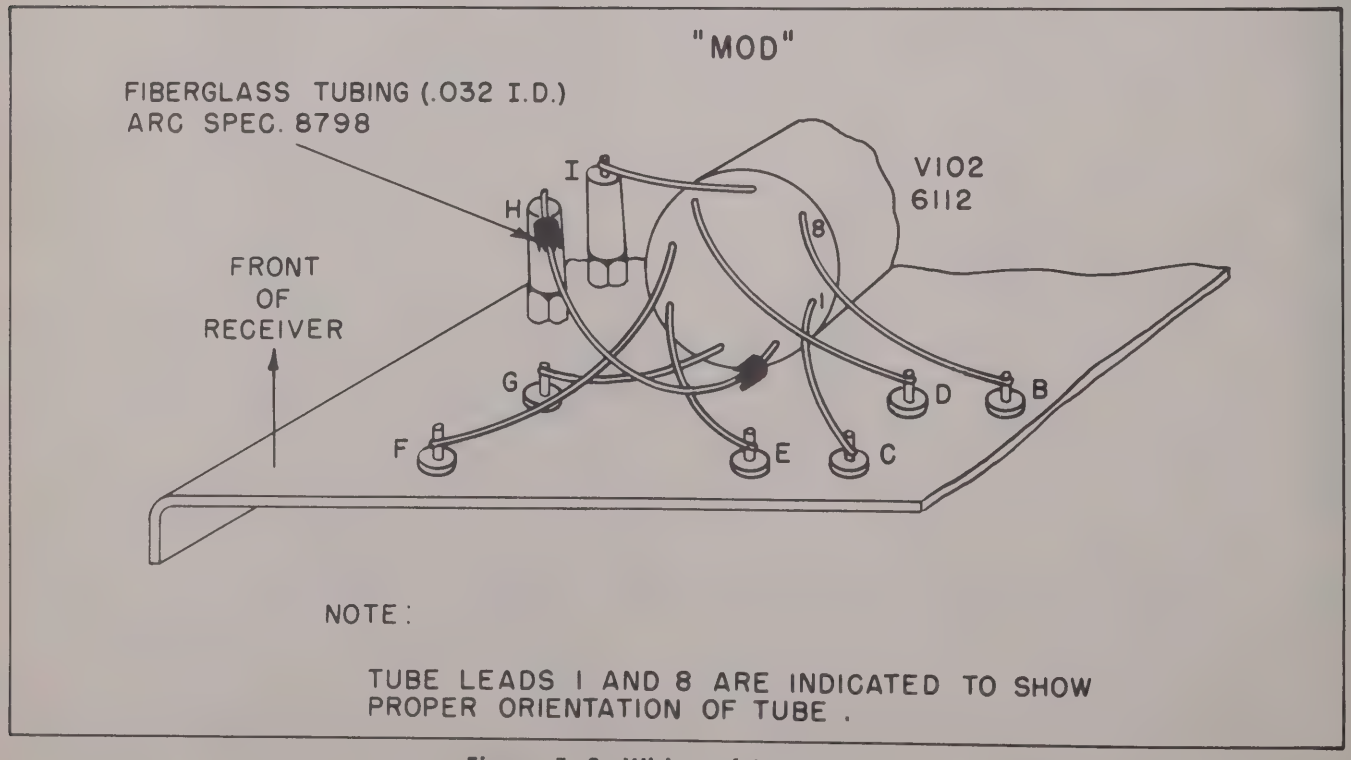
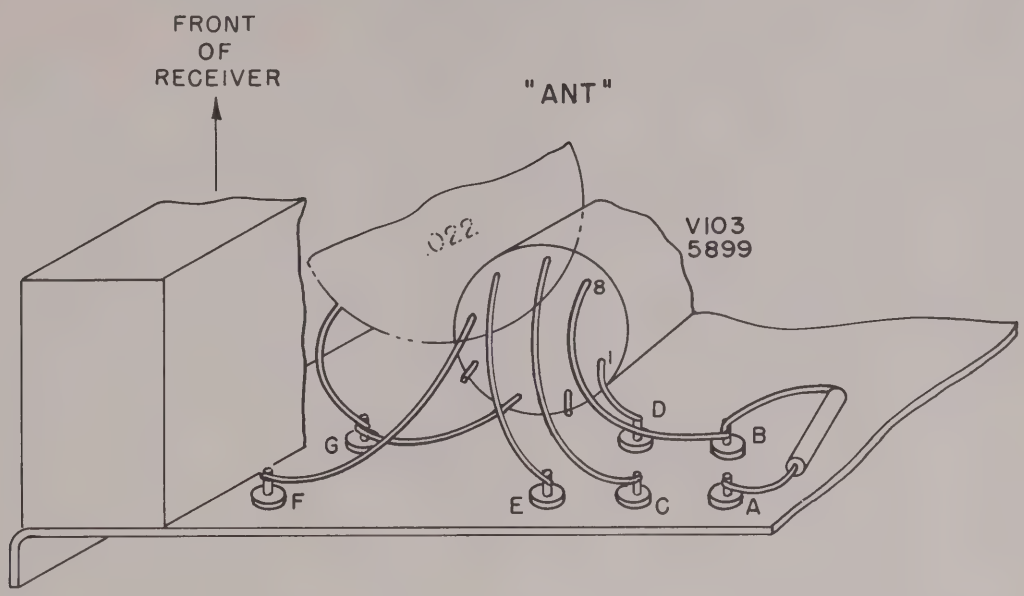


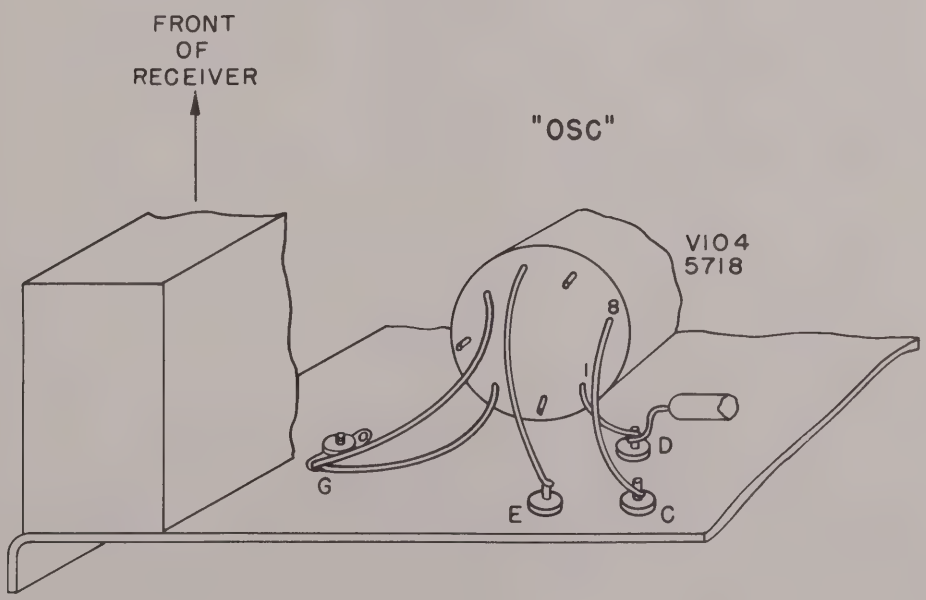
Figure 5–3. Wiring of V102



NOTES:

1. CUT OFF UNUSED TUBE LEADS 2 AND 4 APPROXIMATELY 1/32 INCH FROM GLASS.
2. TUBE LEADS 1 AND 8 ARE INDICATED TO SHOW PROPER ORIENTATION OF TUBE.

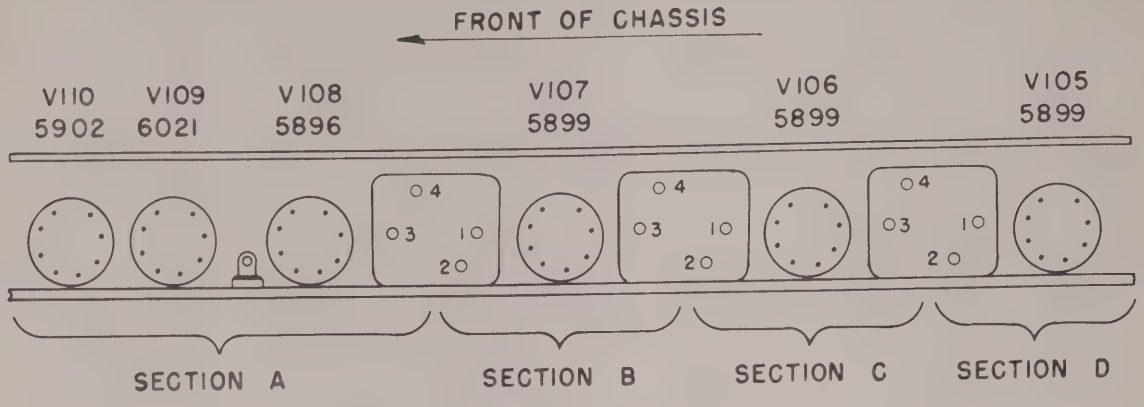
Figure 5–4. Wiring of V103



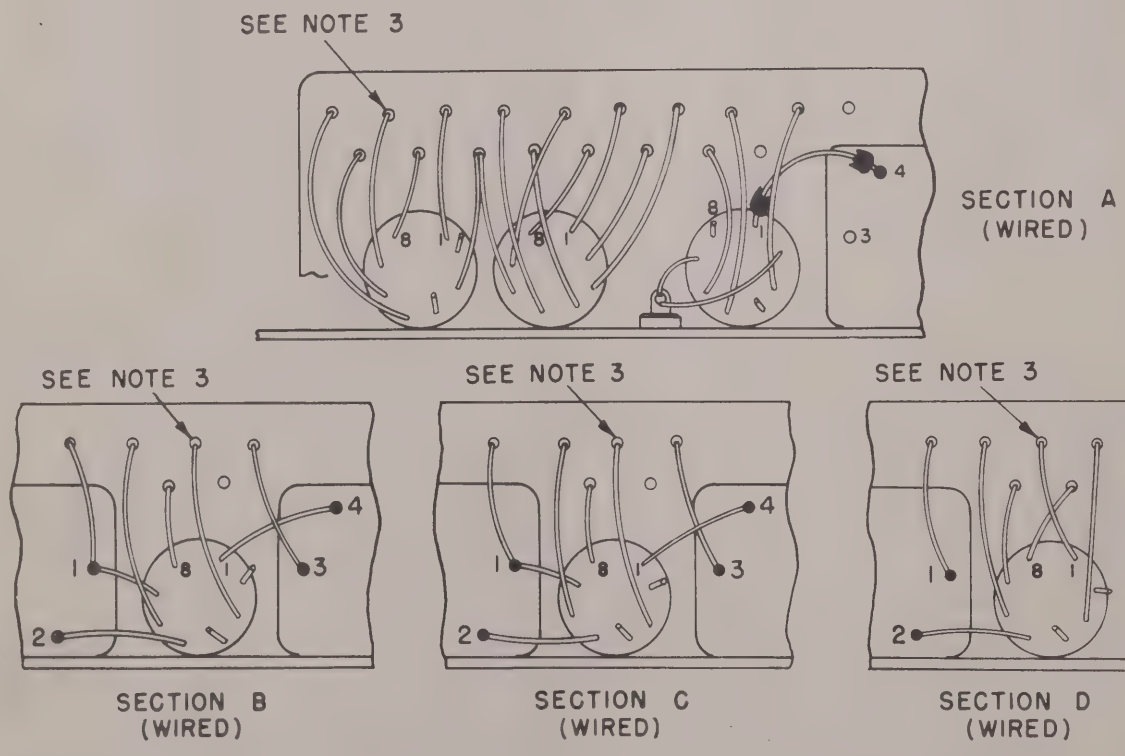
NOTES:

1. CUT OFF UNUSED TUBE LEADS 2, 4 AND 7 APPROXIMATELY 1/32 INCH FROM GLASS.
2. TUBE LEADS 1 AND 8 ARE INDICATED TO SHOW PROPER ORIENTATION OF TUBE.

Figure 5–5. Wiring of V104



BOTTOM VIEW



NOTES:

1. CUT OFF UNUSED TUBE LEADS APPROXIMATELY 1/32 INCH FROM GLASS.
2. TUBE LEADS 1 AND 8 ARE INDICATED TO SHOW PROPER ORIENTATION OF TUBE
3. INSERT TUBE LEADS INTO TERMINALS WITH MAXIMUM EXTENSION OF 1/32 INCH BEYOND TERMINAL. SOLDER ON OPPOSITE SIDE OF TERMINAL BOARD.

Figure 5–6. Wiring of V105, V106, V107, V108, V109, and V110

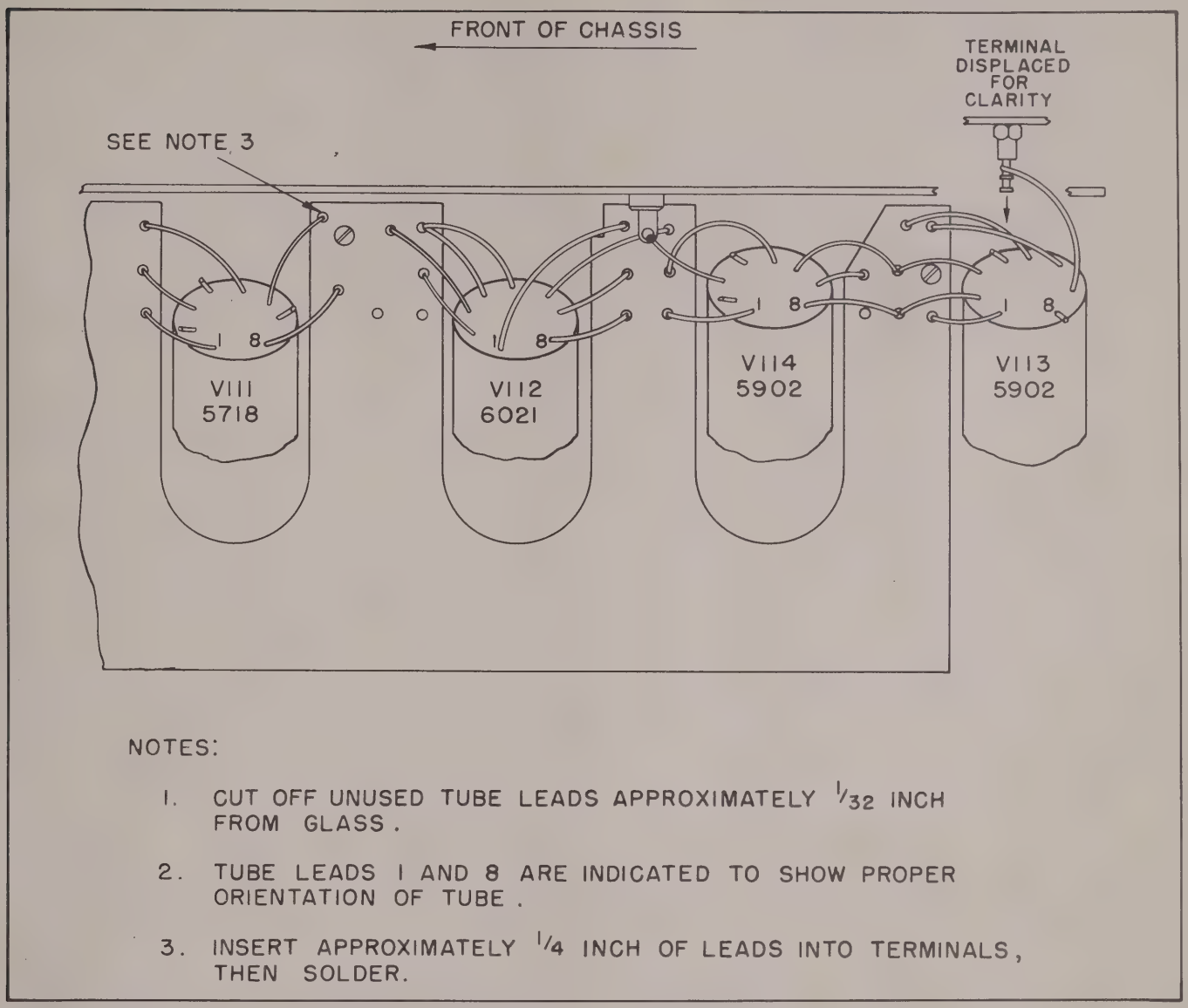


Figure 5–7. Wiring of V111, V112, V113, and V114

5–11. MAINTENANCE OF POWER UNIT TYPE P-14.

5–12. Power Unit Type P-14 comprises a normal dynamotor section and an alternator section with an armature winding, two slip rings and brushes, and a speed governor. The speed governor has a two-segment commutator and brushes, and an associated resistor.

5–13. The bearings, dynamotor, and alternator portions may be serviced in acccordance with standard maintenance procedures. Inspection should be made every 100 hours. The normal life of this dynamtor-alternator will probably exceed 1000 hours without brush changes.

5–14. Failure of the speed governor will usually result in an a-c frequency rise, probably to about 120 cps at normal input voltage and loads .The frequency may be checked with a suitable Frahm Frequency Meter designed for 10- to 15-volt operation, or by comparison on an oscilloscope with a known frequency from an accurate audio-frequency oscillator.

5–15. The P-14 is rated for an accuracy of 100 (±3) cps, but satisfactory ADF operation can be obtained with 100 (±5) cps. If it becomes necessary to correct the speed, first ascertain that the two-segment commutator is in good condition, and that the brushes are free and of sufficient length. To do this, the governor assembly may be removed from the shaft; but note the position of the governor on the shaft before removal, to insure proper replacement. If the frequency remains out of limits of 100 (±3) cps at normal input voltage and normal loads, burnish the contacts carefully so as not to bend the springs. This will require resetting the *outer* screw of the governor, which is done by "trial and error" until the proper frequency is reached. Turning the screw in reduces the frequency. When the adjustment is completed, reseal the screw with glyptal, or equivalent sealing enamel, and allow the glyptal to dry before running the P-14 dynamotor-alternator.

5–16. CIRCUIT ALIGNMENT PROCEDURE.

5–17. GENERAL. Receiver Type R-30 has been aligned and tested at the factory prior to shipment. The design of the R-30 is such that normally it should not be necessary to realign it after the initial factory alignment. There are five trimmer capacitors that can be aligned for each of the three bands of operation. In addition there is one potentiometer for balancing the balanced modulator circuit. All r-f and i-f transformers are prealigned and hermetically sealed at the factory. No attempt should be made to adjust these units; if defective, they can be replaced by new transformers which are prealigned at the factory. All alignment adjustments are available from the top of the receiver chassis.

CAUTION

Inasmuch as available field techniques for setting the gang condensers accurately to alignment points are not as refined as factory methods, it is highly undesirable that the trimmers be realigned unless it is evident that such adjustment is required.

5–18. TEST EQUIPMENT FOR ALIGNMENT. The following test equipment is required for alignment:

Signal Generator, Measurements Model 65B, or equivalent, to cover the frequency range of 190 to 1750 kc.

A 50 μμf capacitor for a dummy antenna.

A 14-volt or 28-volt dc primary power supply, depending on the rating of the equipment undergoing alignment.

A UG-625/U or UG-290/U BNC receptacle, or equivalent, to connect the sense antenna cable to the signal generator, through the 50 μμf capacitor dummy antenna.

A frequency meter or frequency counter capable of measuring frequency accurately in the range of 190 to 1750 kc.

A complete ARC Type 21 ADF, except for Indicator IN-12 (or IN-13), as listed in table 1–1.

A cable harness with plugs for interconnecting the components of the ARC Type 21 ADF (see figure 6–16).

5–19. PRELIMINARY PROCEDURE. The test equipment and the equipment under test are connected as shown in figure 5–8. For proper alignment of the R-30, the relative positions of the C-59 frequency dial and the R-30 tuning capacitor must be aligned. Proceed as follows:

Step 1. With the mechanical linkage interconnected between the R-30 and C-59, rotate the C-59 tuning crank counterclockwise as far as it will go, to bring the R-30 tuning capacitor to its minimum-capacitance setting.

Step 2. Disconnect the mechanical linkage at either end.

Step 3. Turn the tuning crank until the reference line just to the right of the high-frequency end of the dial is aligned with the fiducial line.

Step 4. Reconnect the mechanical linkage, being careful not to disturb the setting of its spline, and recheck the frequency dial and tuning crank positions.

CAUTION

The fiducial line and reference line must be accurately aligned when the tuning capacitor is at its minimum-capacitance setting.

5–20. ALIGNMENT OF TRIMMER CAPACITORS (OSC, 2nd RF, 1st RF, and ANT). To align trimmer capacitors for Band I, Band II, and Band III, proceed as follows:

Step 1. Set the signal generator and Receiver Type R-30 to *exactly 380 kc.* It is desirable that a frequency meter be employed to set the signal generator frequency.

Note

To reduce the effects of backlash, the tuning crank should be rotated in a counterclockwise direction to approach the 380-kc setting, as was the case when approaching the high-end index mark for initial dial alignment.

Step 2. Set the C-59 ANT-COMP switch to COMP.

Step 3. Set the signal generator output to approximately 10,000 microvolts and adjust the Band I oscillator timmer capacitor (C141) for maximum deflection of the tuning meter. This adjustment is located on the top right rear section of the R-30 (see figure 5–9).

Step 4. Align the 2nd RF (C130), 1st RF (C125) and ANT (C119) trimmer capacitors, in sequence, for maximum deflection of the C-59 tuning meter. Repeat Steps 3 and 4 with the signal generator set at approximately 20 microvolts.

Step 5. Repeat Steps 1, 3 and 4 at 800 kc. Band II trimmer capacitor symbols are as follows: OSC (C142), 2nd RF (C131), 1st RF (C126), and ANT (C120).

Step 6. Repeat Steps 1, 3 and 4 at 1650 kc. Band III trimmer capacitor symbols are as follows: OSC (C143), 2nd RF (C132), 1st RF (C127), and ANT (C121).

5–21. ALIGNMENT OF LOOP AMPLIFIER.

Step 1. Disconnect the 50 μμf capacitor from the signal generator ungrounded terminal and connect it across the input end of the ANT cable connector, to terminate the antenna cable in a 50 μμf capacitance.

Step 2. Form a coil of insulated wire, about four feet long and coiled to about three inches diameter, and connect it across the signal generator terminals. This coil will be used to radiate a signal into the loop.

Step 3. Set the C-59 ANT-COMP switch to COMP.

Step 4. Set the signal generator and R-30 receiver to *exactly 380 kc.*

Step 5. With the signal generator radiating coil about three feet away from the L-11 loop in a direction approximately at right angles to the axis of the ferrite bar, increase the signal generator level until the tuning meter

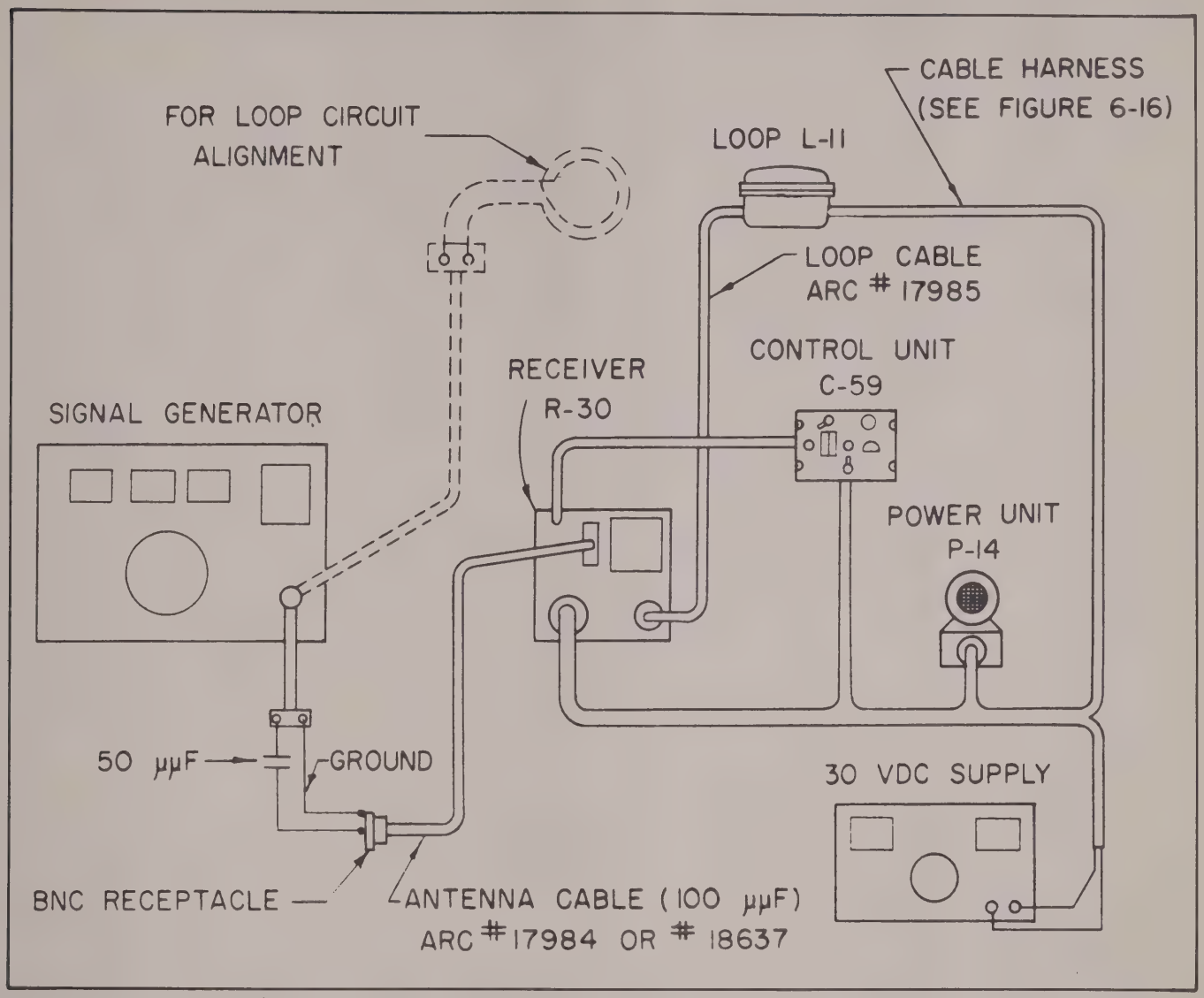


Figure 5–8. Bench Test Set-up for Alignment of Receiver Type R-30

is deflected about one division. The axis of the radiating coil should be parallel to the axis of the ferrite bar for best pick-up of the signal.

Step 6. Adjust the Band I loop circuit trimmer (C101) for maximum deflection of the tuning meter.

Step 7. Repeat Steps 4 and 5 at 800 kc, adjusting the Band II loop circuit trimmer (C102).

Step 8. Repeat Steps 4 and 5 at 1650 kc, adjusting the Band III loop circuit trimmer (C103).

5–22. BALANCED MODULATOR ADJUSTMENT. To adjust the balance of the balanced modulator circuit, proceed as follows:

Step 1. Connect the test equipment as shown in the alignment test set-up, figure 5–8. Set the R-30 receiver to approximately 380 kc with no signal input. Ascertain that no signal is being received at the dial setting used.

Step 2. Set the C-59 ANT-COMP switch to COMP.

Step 3. Adjust the MOD BAL control, R108 (see figure 5–9), for minimum rotational speed of the loop. Change the BAND switch successively to Band II (.40–.84 MC) and Band III (.84–1.75 MC), and note the rotation of the loop. Make certain that no signals are being received in the two bands at the dial setting used. Reset the MOD BAL potentiometer for optimum compromise on all bands. Under no-signal conditions, for the final adjustment of this control, the loop should not travel faster than 180 degrees in 30 seconds, in any band.

5–23. RECEIVER MEASUREMENTS.

5–24. Tables 5–1, 5–2, and 5–3 list typical voltage, resistance, and stage gain measurements for Receiver Type R-30. These measurements were made under the conditions noted in each table.

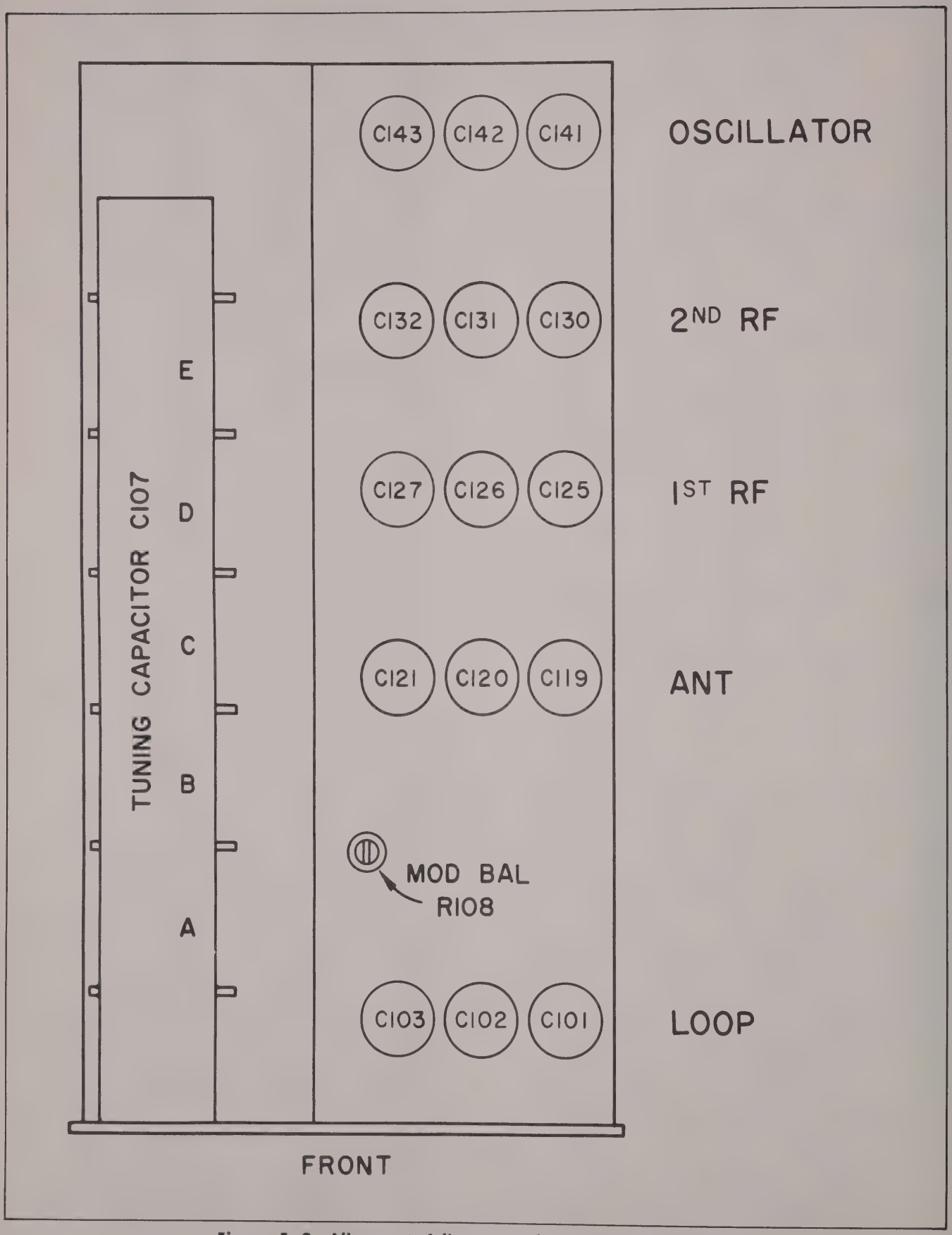


Figure 5–9. Alignment Adjustments for Receiver Type R-30

TABLE 5—1. VOLTAGE MEASUREMENTS FOR RECEIVER TYPE R-30

CONDITIONS:

1. All measurements made with a 20,000 ohms-per-volt voltmeter, equivalent to Simpson Model 260, or 1,000 ohms-per-volt voltmeter, equivalent to Weston Model 564, using the meter scale noted.
2. All voltages are positive dc, and are measured with respect to chassis ground, unless noted otherwise.
3. Input voltage: 27.5 volts dc measured at pin I of D-10A dynamotor.
4. C-59 ANT-COMP switch in COMP position and VOL control in maximum position.
5. R-30 tuning capacitor fully meshed (maximum capacitance).

Test Point		20,000 Ohms-per-volt Meter		1,000 Ohms-per-volt Meter	
Tube	Pin No.	Scale	Voltage	Scale	Voltage
V101 (5899) LOOP AMPLIFIER	1	2.5	0	3	0
	2	—	—	—	—
	3	2.5	0	3	0
	4	—	—	—	—
	5	250	51	30	22.5
	6	10	6.3	30	6.3
	7	50	34.5	30	11.6
	8	2.5	0.73	3	0.65
V102 (6112) BALANCED MODULATOR	1	250	92	300	68
	2	2.5	0	3	0
	3	10	6.3	30	6.3
	4	10	6.0	30	5.0
	5	10	6.0	30	5.0
	6	50	12.6	30	12.6
	7	2.5	0	3	0
	8	250	92	300	67
V103 (5899) 1st RF AMPLIFIER	1	2.5	*	3	*
	2	—	—	—	—
	3	2.5	0	3	0
	4	—	—	—	—
	5	250	93	300	90
	6	10	6.3	30	6.3
	7	250	93	300	90
	8	2.5	2.0	3	1.85
V104 (5718) OSCILLATOR	1	10	‡	Do not use	
	2	—	—	—	—
	3	2.5	0	30	0
	4	—	—	—	—
	5	2.5	0	3	0
	6	10	6.3	30	6.3
	7	—	—	—	—
	8	250	102	300	90
V105 (5899) MIXER	1	10	†	3	†
	2	—	—	—	—
	3	10	6.3	30	6.3
	4	—	—	—	—
	5	250	116	300	110
	6	50	12.6	30	12.6
	7	250	37	30	10.3
	8	10	3.4	3	2.1

See footnotes at end of table.

TABLE 5—1. VOLTAGE MEASUREMENTS FOR RECEIVER TYPE R-30 — Continued

Test Point		*20,000 Ohms-per-volt Meter*		*1,000 Ohms-per-volt Meter*	
Tube	*Pin No.*	*Scale*	*Voltage*	*Scale*	*Voltage*
V106 (5899) 1st IF AMPLIFIER	1	2.5	*	3	*
	2	—	—	—	—
	3	50	12.6	30	12.6
	4	—	—	—	—
	5	250	94	300	94
	6	50	18.9	30	18.9
	7	250	94	300	94
	8	2.5	0.96	3	0.96
V107 (5899) 2nd IF AMPLIFIER	1	2.5	0	3	0
	2	—	—	—	—
	3	50	18.9	30	18.9
	4	—	—	—	—
	5	250	91	300	87
	6	50	25.2	30	25.2
	7	250	91	300	87
	8	2.5	1.57	3	1.5
V108 (5896) DETECTOR-AVC	1	2.5	*	3	*
	2	2.5	0	3	0
	3	50	18.9	30	18.9
	4	—	—	—	—
	5	2.5	*	3	*
	6	50	25.2	30	25.2
	7	2.5	0	3	0
	8	—	—	—	—
V109 (6021) AVC CLAMP — 1st AUDIO AMPLIFIER	1	2.5	*	3	*
	2	2.5	*	3	*
	3	50	25.2	30	25.2
	4	2.5	0	3	0
	5	2.5	1.2	3	1.1
	6	50	18.9	30	18.9
	7	2.5	0	3	0
	8	250	57	300	51
V110 (5902) 2nd AUDIO AMPLIFIER	1	2.5	0	3	0
	2	—	—	—	—
	3	50	18.9	30	18.9
	4	—	—	—	—
	5	250	129	300	125
	6	50	12.6	30	12.6
	7	250	110	300	110
	8	50	11.5	30	11.3
V111 (5718) 1st 100 CPS AMPLIFIER	1	2.5	0	3	0
	2	—	—	—	—
	3	50	25.2	30	25.2
	4	—	—	—	—
	5	2.5	1.5	3	0.96
	6	50	18.9	30	18.9
	7	—	—	—	—
	8	250	50	300	43

See footnotes at end of table.

TABLE 5—1. VOLTAGE MEASUREMENTS FOR RECEIVER TYPE R-30 — Continued

Test Point		20,000 Ohms-per-volt Meter		1,000 Ohms-per-volt Meter	
Tube	Pin No.	Scale	Voltage	Scale	Voltage
V112	1	250	80	300	70
(6021)	2	2.5	0	3	0
2nd 100 CPS	3	50	12.6	30	12.6
AMPLIFIER —	4	10	2.7	30	2.0
PHASE INVERTER	5	10	2.7	30	2.0
	6	50	18.9	30	18.9
	7	2.5	0	3	0
	8	250	80	300	70
V113	1	2.5	0	3	0
(5902)	2	50	15.5	30	15.5
½-PUSH-PULL	3	10	6.3	30	6.3
100 CPS	4	—	—	—	—
AMPLIFIER	5	250	130	300	130
	6	50	12.6	30	12.6
	7	250	130	300	130
	8	—	—	—	—
V114	1	2.5	0	3	0
(5902)	2	—	—	—	—
½-PUSH-PULL	3	2.5	0	3	0
100 CPS	4	—	—	—	—
AMPLIFIER	5	250	130	300	130
	6	10	6.3	30	6.3
	7	250	130	300	130
	8	50	15.5	30	15.5

* Small negative voltage not exceeding —1 volt.
† Small negative voltage not exceeding —3 volts.
‡ Oscillator circuit. Voltage dependent on meter leads, band, and tuning capacitor position. Voltage should not exceed —7 volts.

TABLE 5—2. RESISTANCE MEASUREMENTS FOR RECEIVER TYPE R-30

CONDITIONS:

1. All cables disconnected from R-30 receiver.
2. All resistance values are in ohms. Multipliers: K=1,000; MEG=1,000,000. Measurements are made with respect to chassis ground; negative ohmmeter probe grounded, unless noted otherwise.
3. BAND switch in .19—.40 MC position.

TUBE	PIN NUMBER							
	1	2	3	4	5	6	7	8
V101	23.5	—	—	—	*	—	*	470
V102	*	330K	—	27K	27K	—	330K	*
V103	400K—700K †	—	—	—	*	—	*	*
V104	100K	—	—	—	0	—	—	*
V105	400K—700K †	—	—	—	*	—	*	2.2K
V106	1.2—2.0 MEG †	—	—	—	*	—	*	*
V107	12	—	—	—	*	—	*	330
V108	430K	0	—	—	220K	—	0	—
V109	300K—600K †	300K—600K †	—	0	1.1K	—	470K	*
V110	470K	—	—	—	∞	—	*	470
V111	520K	—	—	—	2.7K	—	—	*
V112	∞	470K	—	2.7K	2.7K	—	30K	∞
V113	540K	330	—	—	∞	—	∞	—
V114	510K	—	—	—	∞	—	∞	330

* Greater than 500K.
† Voltmeter probe at positive potential grounded.

TABLE 5—3. STAGE GAIN MEASUREMENTS FOR RECEIVER TYPE R-30

CONDITIONS:

1. AVC line shorted to ground. (Terminal 3 of Z105 shorted to chassis.)
2. C-59 ANT-COMP switch to COMP position, and VOL set at maximum.
3. Signal applied to J102 (antenna input) of R-30 is through a 50 μμf capacitor dummy antenna and an antenna cable of 100 μμf capacitance, such as ARC-17984 or ARC-18637. Signal applied to all other measurement points is made directly from the ungrounded signal generator terminal, with the signal generator ground terminal connected to the receiver chassis.
4. The input shown is the signal level required to obtain —10 volts dc between the junction of resistors R130 and R131 (at the detector load) and the chassis. The voltage must be read by a d-c vacuum tube voltmeter.
5. The voltage levels shown in table 5—3 are average values. Variations of 100 percent or more from these values may be encountered in normal receivers, due to vacuum tube variations of the cascaded stages of the receiver. The greatest variations will be encountered on the antenna input readings, and at terminal 1 of V103, due to the effects of receiver noise and the fact that all amplifiers are in use.

R-F MEASUREMENTS

Frequency	Band	μV At J102 Antenna Input	μV At Terminal No. 1 of V103	μV At Terminal No. 1 of V105
210	.19– .40 MC	4.5	16	25
380	.19– .40 MC	3	17	25
450	.40– .84 MC	6	16	25
800	.40– .84 MC	4	15	25
950	.84–1.75 MC	6.5	11	25
1650	.84–1.75 MC	5	12	25

I-F MEASUREMENTS

Note

The i-f measurements are made with the receiver tuned to 190 kc. The signal generator frequency is 142.5 kc.

Frequency	μV At Terminal No. 1 of V105	μV At Terminal No. 1 of V106	μV At Terminal No. 1 of V107
142.5	22	1200	300,000

SECTION VI

DRAWINGS

Figure	*Title*	*Page*
6—1.	Receiver Type R-30, Schematic Diagram	45/46
6—2.	Receiver Type R-30, Wiring Diagram	47/48
6—3.	Receiver Type R-30, Loop Unit, Wiring Diagram	49/50
6—4.	Receiver Type R-30, Modulator Unit, Wiring Diagram	51/52
6—5.	Receiver Type R-30, Antenna Unit, Wiring Diagram	53/54
6—6.	Receiver Type R-30, First R-F Unit, Wiring Diagram	55/56
6—7.	Receiver Type R-30, Second R-F Unit, Wiring Diagram	57/58
6—8.	Receiver Type R-30, Oscillator Unit, Wiring Diagram	59/60
6—9.	Receiver Type R-30, Band Selector, Wiring Diagram	61
6—10.	Control Unit Type C-59, Schematic Diagram	62
6—11.	Control Unit Type C-59, Wiring Diagram	63/64
6—12.	Loop Type L-11, Schematic Diagram	65/66
6—13.	Loop Type L-11, Wiring Diagram	67/68
6—14.	Power Unit Type P-14, Schematic Diagram	69/70
6—15.	Power Unit Type P-14, Wiring Diagram	71/72
6—16.	ARC Type 21 ADF, Single ADF Installation, External Connection Diagram	73/74
6—17.	ARC Type 21 ADF, Single ADF Installation, Cabling Diagram	75/76
6—18.	ARC Type 21 ADF, Dual ADF Installation, External Connection Diagram	77/78
6—19.	ARC Type 21 ADF, Dual ADF Installation, Cabling Diagram	79/80
6—20.	Panel Mounting Dimensions for Installation of Dial Gearing Unit and Mask in Custom Control Panel	81/82
6—21.	Panel Mounting Dimensions for Installation of Tuning Meter in Custom Control Panel	83/84
6—22.	Sample Form for Compensation Data Curve (Spare)	85

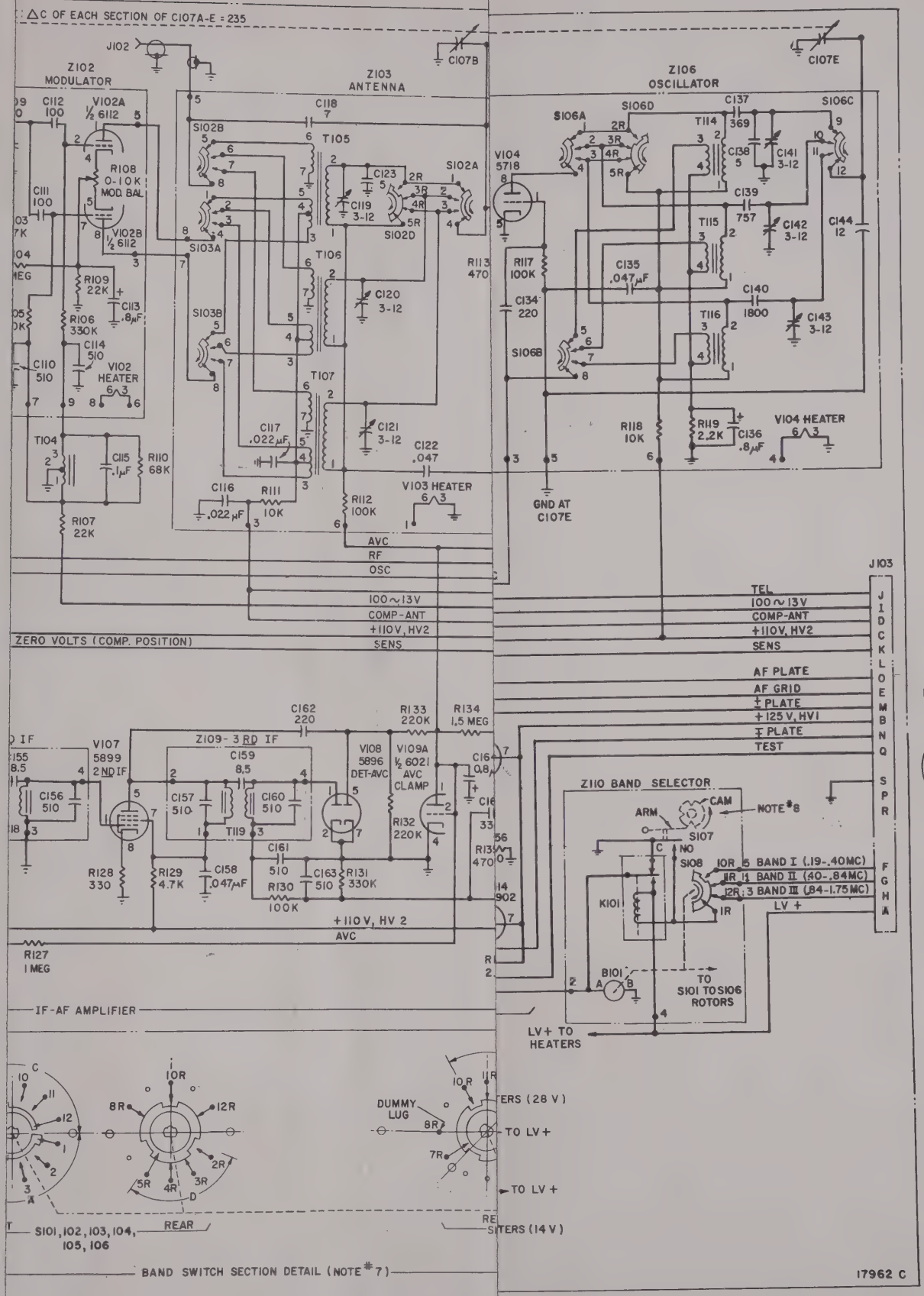


Figure 6—1. Receiver Type R-30, Schematic Diagram

NOTES:

1. 14-VOLT AND 28-VOLT RECEIVERS DIFFER IN HEATER WIRING AND IN COMPONENTS USED FOR MOTOR B101 AND RELAY K101.

2. ASSOCIATED WIRING DIAGRAMS ARE AS FOLLOWS:

UNIT	FIGURE NO.
MAIN CHASSIS	6-2
LOOP UNIT	6-3
MODULATOR UNIT	6-4
ANTENNA UNIT	6-5
FIRST R-F UNIT	6-6
SECOND R-F UNIT	6-7
OSCILLATOR UNIT	6-8
BAND SELECTOR	6-9

3. ALL INDUCTOR VALUES ARE IN MICROHENRIES (μH) UNLESS OTHERWISE NOTED.

4. ALL CAPACITOR VALUES ARE IN MICROMICROFARADS (μμF) UNLESS OTHERWISE SPECIFIED.

5. ALL RESISTANCE VALUES ARE IN OHMS. MULTIPLIERS: K = 1,000; MEG = 1,000,000.

6. ALL SWITCHES ARE SHOWN IN BAND I POSITION.

7. SWITCHES S101-S106 AND S108 GO THROUGH THREE COMPLETE BAND-SELECTION CYCLES IN THE COURSE OF ONE SHAFT REVOLUTION, DIFFERENT SECTORS OF A ROTOR AT ANY GIVEN CIRCUIT LOCATION COMING INTO USE AT EACH CYCLE. FOR CLARITY, AT EACH SWITCH LOCATION IN THE MAIN DIAGRAM ONLY THE ACTIVE 120 ROTOR SECTOR IS SHOWN, ARROWS INDICATE DIRECTION OF ROTATION. FOR ADDITIONAL INFORMATION SEE SWITCH DETAILS. STATOR SECTORS ARE REPRESENTED BY THE LETTERS A, B, AND C FOR THE FRONT SECTORS, AND D FOR THE REAR SECTOR. STATOR SECTORS IN USE ARE AS FOLLOWS: S101-A, B, C, D; S102-A, B, D; S103-A, B; S104-A, B, D; S105-A, B, C, D; S106-A, B, C, D; S108-D.

8. S107 IS OPERATED BY A MOTOR-DRIVEN CAM, ROTATING AT THREE TIMES BAND SWITCH SPEED, AND ACTS AS A VERNIER TO OPEN THE MOTOR CIRCUIT AT PRECISE ANGLES.

9. THE INTERMEDIATE FREQUENCY IS 142.5 KC (OSCILLATOR FREQUENCY IS HIGHER THAN SIGNAL FREQUENCY).

10. DC VOLTAGES ARE APPROXIMATE AND ARE BASED ON THE FOLLOWING CONDITIONS:

    (A) RECEIVER CONNECTED IN COMPLETE SYSTEM INCLUDING POWER UNIT TYPE P-14, CONTROL UNIT TYPE C-59, LOOP TYPE L-11, AND INDICATOR TYPE IN-12 OR TYPE IN-13.

    (B) LV+ AT TERMINAL B OF POWER UNIT RECEPTACLE SET AT 13.5 VOLTS FOR 14-VOLT RECEIVER, OR 27.0 VOLTS FOR 28-VOLT RECEIVER.

    (C) CONTROL UNIT FUNCTION SWITCH IN "COMP" POSITION; NO SIGNAL INPUT.

    (D) NEGATIVE TERMINAL OF VOLTMETER GROUNDED TO CHASSIS.

    (E) VOLTMETER OHMS-PER-VOLT: EITHER 1,000 OR 20,000, EXCEPT WHERE SPECIFICALLY INDICATED.

11. AC VOLTAGES ARE APPROXIMATE AND ARE AS MEASURED TO GROUND WITH A VACUUM TUBE VOLTMETER.

12. REFERENCE DESIGNATIONS C152 AND R157 WILL BE FOUND NEAR V103 AND R113.

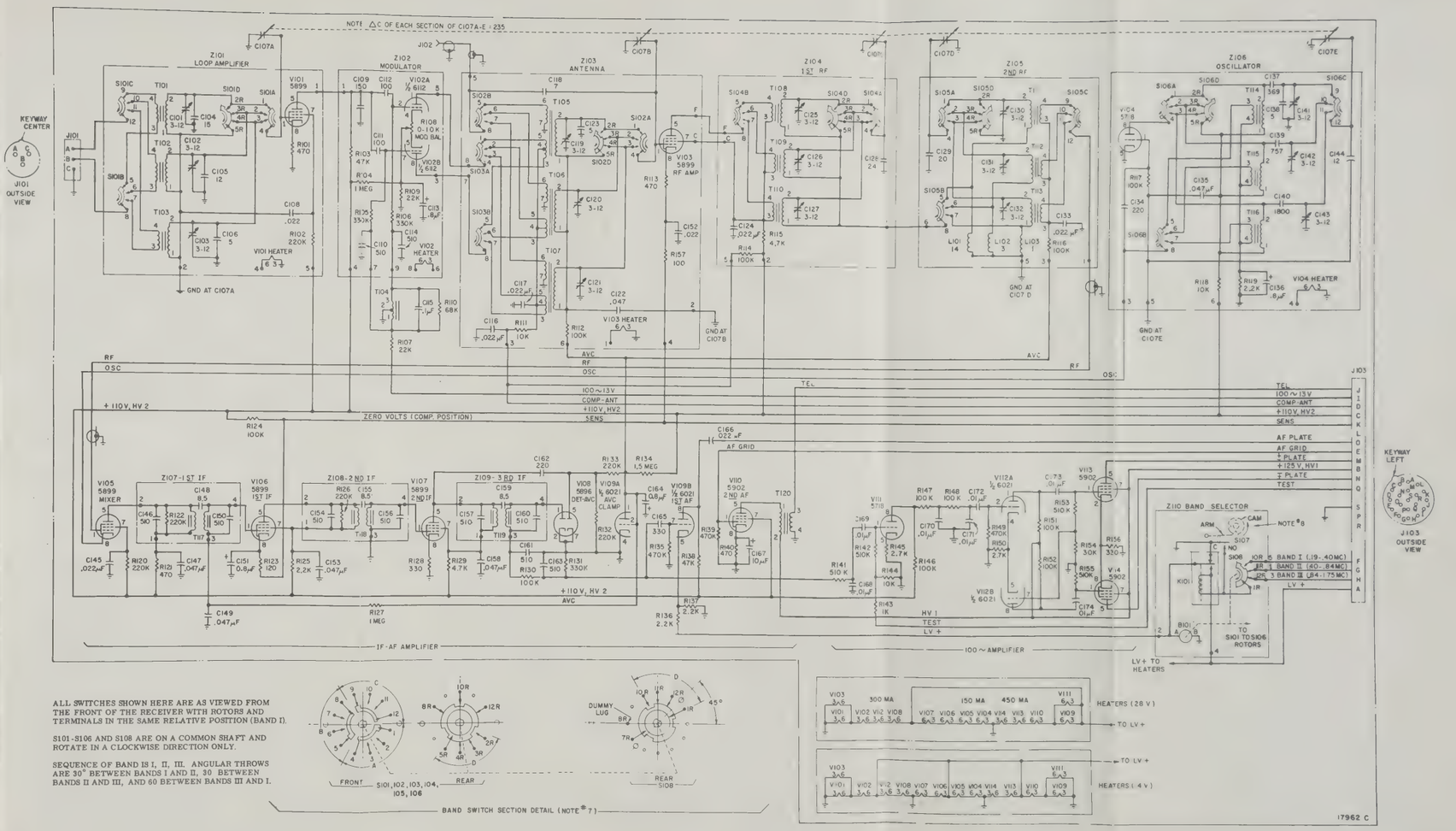
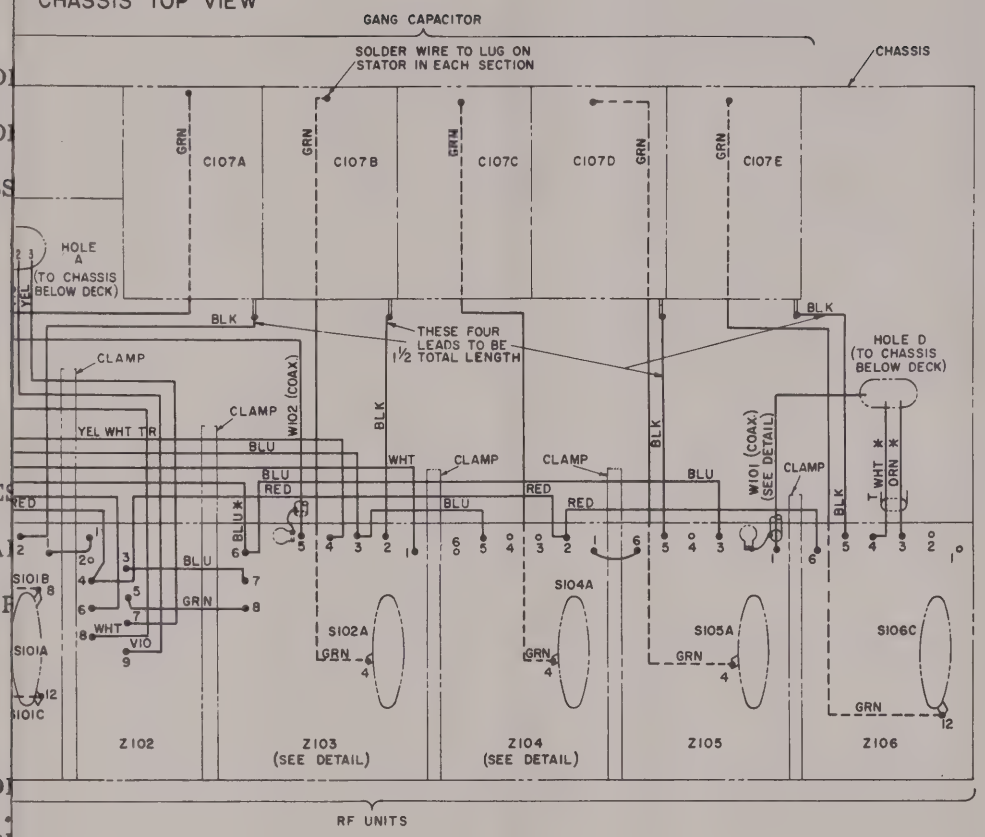
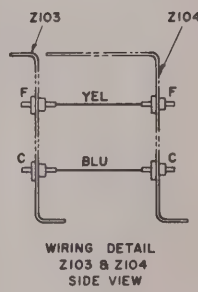


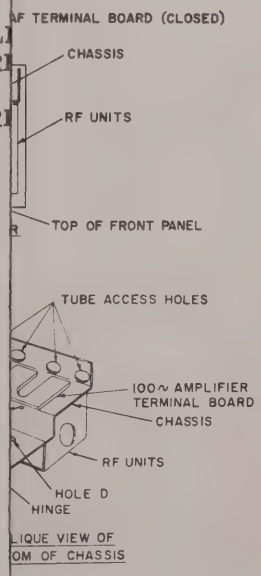
Figure 6—1. Receiver Type R-30, Schematic Diagram

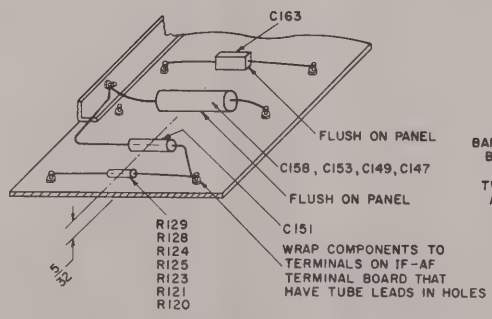
NOTES:

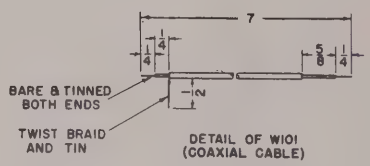
1. FO
2. FO
3. ASS
4. RES
5. CA
6. WIR
7. FO
(...
FO
(+++
8. ALI
ARI
9. DRI
(A)
(B)
(C)
(D)
(E)
(F)
(G)

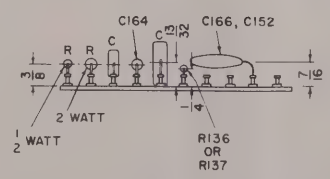




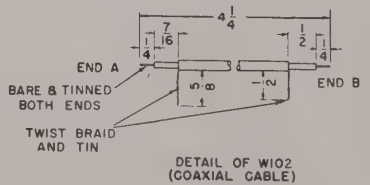








MOUNTING DIMENSIONS FOR COMPONENTS



17961 C

Figure 6—2. Receiver Type R-30, Wiring Diagram

NOTES:

1. FOR COMPONENT PART MOUNTING DIMENSIONS AND OTHER CONSIDERATIONS SEE DETAILS.
2. FOR SCHEMATIC DIAGRAM SEE FIGURE 6-1.
3. ASSOCIATED WIRING DIAGRAMS FOR COMPLETE WIRING OF RECEIVER ARE AS FOLLOWS:

UNIT	FIGURE NO.
LOOP UNIT (Z101)	6-3
MODULATOR UNIT (Z102)	6-4
ANTENNA UNIT (Z103)	6-5
FIRST R-F UNIT (Z104)	6-6
SECOND R-F UNIT (Z105)	6-7
OSCILLATOR UNIT (Z106)	6-8
BAND SELECTOR (Z110)	6-9

4. RESISTANCE VALUES ARE IN OHMS. MULTIPLIERS: K = 1,000; MEG = 1,000,000.
5. CAPACITANCE VALUES ARE IN MICROMICROFARADS (μμF) UNLESS OTHERWISE SPECIFIED.
6. WIRES:

MARKING SHOWN	DESCRIPTION
COLOR NOTE	#24 SOLID COPPER TEFLON INSULATED.
COLOR NOTE & ASTERISK (*)	#24 STRANDED COPPER, TEFLON INSULATED.
UNMARKED	#24 BARE, SOLID, TINNED COPPER.

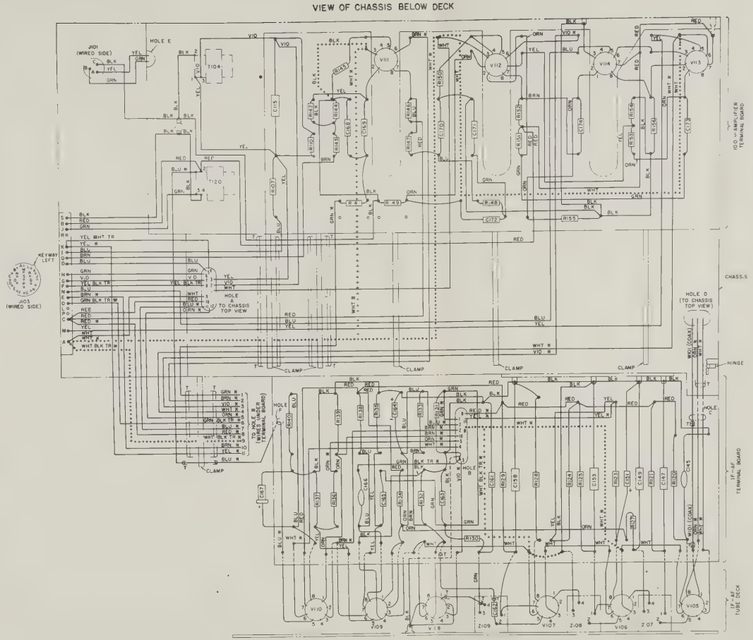
7. FOR 28-VOLT RECEIVER, WIRES MARKED (+++++) ARE CONNECTED, AND WIRES MARKED (-----) ARE OMITTED.
   FOR 14-VOLT RECEIVER, WIRES MARKED (-----) ARE CONNECTED, AND WIRES MARKED (+++++) ARE OMITTED.
8. ALL ELECTRON TUBES ARE VIEWED TOWARD BASE. TUBES V111, V112, V113, AND V114 ARE SHOWN DISPLACED 90° FOR CLARITY.
9. DRESSING OF LEADS:
   (A) AVOID SHARP BENDS IN ALL WIRES.
   (B) COVER ALL WIRES OR GROUPS OF WIRES MARKED "T" WITH TEFLON IMPREGNATED FIBERGLAS TUBING OF APPROPRIATE SIZE.
   (C) CUT OFF ALL UNUSED TUBE LEADS APPROXIMATELY 1/32" FROM GLASS.
   (D) DRESS ALL BARE, TUBE, AND COMPONENT LEADS 1/16" MIN. APART.
   (E) SOLDER ALL LEADS TO Z107, Z108, AND Z109 1/16" MIN. FROM GLASS INSULATION.
   (F) KEEP R-F UNIT MOUNTING HOLES (AND SCREWS) IN 100-CYCLE AMPLIFIER TERMINAL BOARD FREE OF WIRES.
   (G) CABLE AND WIRES THROUGH HOLE "C" IN IF-AF TERMINAL BOARD MUST BE LONG ENOUGH TO PERMIT FULL OPENING OF HINGE WITHOUT BEING STRAINED.

SYMBOL IDENTIFICATION TABLE

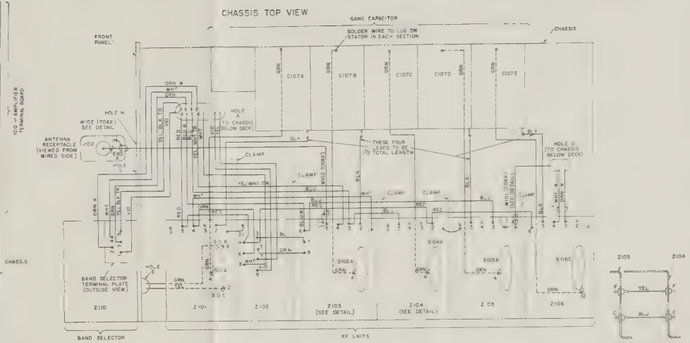
SYMBOL NO.	DRAWING NO.	DESCRIPTION
C1 thru A-E	18688	Δ C = 235 PER SECTION
C115	8802	0.1 uF
C145	8627	.022 uF
C147	8747	.047 uF
C149	8747	.047 uF
C151	8746	0.8 uF
C153	8747	.047 uF
C158	8747	.047 uF
C161	8706	510
C162	8706	220
C163	8706	510
C164	8746	0.8 uF
C165	8706	330
C166	8627	.022 uF
C167	8772	.10 uF
C168	8618	.01 uF
C169	8618	.01 uF
C170	8618	.01 uF
C171	8618	.01 uF
C172	8618	.01 uF
C173	8618	.01 uF
C174	8618	.01 uF
J101	12926	RECEPTACLE (3 PIN)
J102	15185	RECEPT. (UG-625/U)
J103	12357	RECEPTACLE (19 PIN)
R107	201	22 K
R110	201	68 K
R120	201	220 K
R121	201	470
R123	201	120
R124	201	100 K
R125	201	2.2 K
R127	204	1 MEG
R128	201	330
R129	201	4.7 K
R130	204	100 K
R131	201	330 K
R132	201	220 K
R133	201	220 K

SYMBOL NO.	DRAWING NO.	DESCRIPTION
R134	201	1.5 MEG
R135	201	470 K
R136	201	2.2 K
R137	201	2.2 K
R138	201	47 K
R139	201	470 K
R140	201	470
R141	201	510 K
R142	201	510 K
R143	201	1 K
R144	201	10 K
R145	201	2.7 K
R146	201	100 K
R147	201	100 K
R148	201	100 K
R149	201	470 K
R150	201	2.7 K
R151	201	100 K
R152	201	100 K
R153	201	510 K
R154	201	30 K
R155	201	510 K
R156	203	330
T104	18053	MOD. TRANSFORMER
T120	18052	AF TRANSFORMER
V105	TYPE 5899	VACUUM TUBE
V106	TYPE 5899	VACUUM TUBE
V107	TYPE 5899	VACUUM TUBE
V108	TYPE 5896	VACUUM TUBE
V109	TYPE 6021	VACUUM TUBE
V110	TYPE 5902	VACUUM TUBE
V111	TYPE 5718	VACUUM TUBE
V112	TYPE 6021	VACUUM TUBE
V113	TYPE 5902	VACUUM TUBE
V114	TYPE 5902	VACUUM TUBE
W101	18327	COAXIAL CABLE
W102	18079	COAXIAL CABLE
Z101	17890	LOOP UNIT
Z102	17870	MOD UNIT
Z103	18120	ANT UNIT
Z104	17810	1ST. RF UNIT
Z105	17820	2ND. RF UNIT
Z106	17910	OSC UNIT
Z107	18171	1ST. IF TRANSFORMER
Z108	18171	2ND. IF TRANSFORMER
Z109	18173	3RD. IF TRANSFORMER
Z110	17930	BAND SELECTOR UNIT

VIEW OF CHASSIS BELOW DECK



CHASSIS TOP VIEW



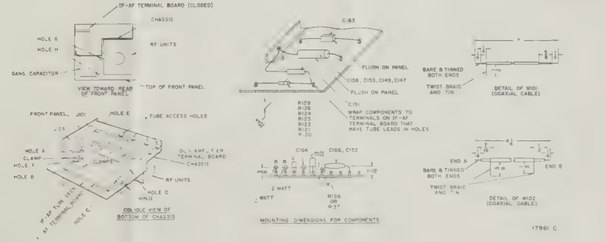


Figure 6-2. Receiver Type R-30, Wiring Diagram

NOTES:

1. ALL WIRES MARKED WITH AN ASTERISK FROM GROUND AND OTHER LEADS.
2. FOR ASSOCIATED SCHEMATIC DIAGRAM
3. FOR ASSOCIATED MAIN CHASSIS WIRING
4. RESISTANCE VALUES ARE IN OHMS. M
5. CAPACITANCE VALUES ARE IN MICROM
6. ALL WIRES MARKED WITH COLOR NOTE
7. ALL UNMARKED WIRES ARE #24 BARE
8. ELECTRON TUBE V101 VIEWED TOWARD
9. DRESS BARE TUBE LEADS WITH 1/16" M APPROX. 1/32" FROM GLASS.
10. SOLDER ALL WIRES TO TRANSFORMERS FROM TERMINAL PLATE.
11. SWITCH SECTIONS:

SECTION	TERMINAL
S101A	1, 2, 3, 4
S101B	5, 6, 7, 8
S101C	9, 10, 11, 1
S101D	2R, 3R, 4R

SYMBOL IDENTIF

SYMBOL NO.	DRAWING
C101	8743
C102	8743
C103	8743
C104	8751
C105	8750
C106	8752
C108	8627
R101	201
R102	201
S101 A-D	17807
T101	18592
T102	18601
T103	18605
V101	TYPE 58
Z101	17890

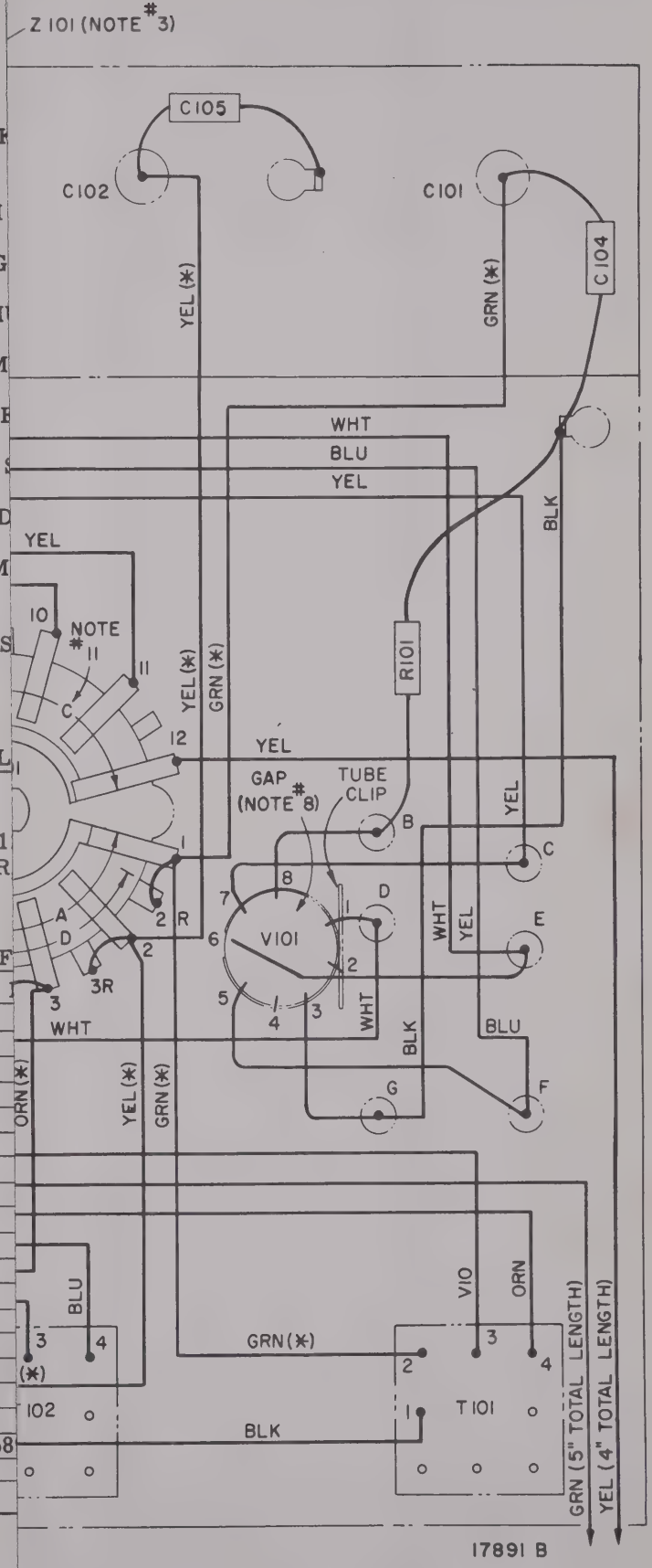


Figure 6—3. Receiver Type R-30, Loop Unit, Wiring Diagram

NOTES:

1. ALL WIRES MARKED WITH AN ASTERISK (*) SHOULD BE AS SHORT AS POSSIBLE AND FREE FROM GROUND AND OTHER LEADS.
2. FOR ASSOCIATED SCHEMATIC DIAGRAM SEE FIGURE 6-1.
3. FOR ASSOCIATED MAIN CHASSIS WIRING DIAGRAM SEE FIGURE 6-2.
4. RESISTANCE VALUES ARE IN OHMS. MULTIPLIER: K = 1,000.
5. CAPACITANCE VALUES ARE IN MICROMICROFARADS (μμF) UNLESS OTHERWISE SPECIFIED.
6. ALL WIRES MARKED WITH COLOR NOTE ARE #24 SOLID COPPER, TEFLON INSULATED.
7. ALL UNMARKED WIRES ARE #24 BARE SOLID TINNED COPPER.
8. ELECTRON TUBE V101 VIEWED TOWARD BASE. ORIENT TUBE IN CLIP AS SHOWN.
9. DRESS BARE TUBE LEADS WITH 1/16" MIN. CLEARANCE. CUT OFF UNUSED LEADS 2 AND 4 APPROX. 1/32" FROM GLASS.
10. SOLDER ALL WIRES TO TRANSFORMERS T101, T102, AND T103 WITH 1/16" MIN. CLEARANCE FROM TERMINAL PLATE.
11. SWITCH SECTIONS:

SECTION	TERMINAL
S101A	1, 2, 3, 4
S101B	5, 6, 7, 8
S101C	9, 10, 11, 12
S101D	2R, 3R, 4R, 5R

SYMBOL IDENTIFICATION TABLE

SYMBOL NO.	DRAWING NO.	DESCRIPTION
C101	8743	3-12 (VARIABLE)
C102	8743	3-12 (VARIABLE)
C103	8743	3-12 (VARIABLE)
C104	8751	15
C105	8750	12
C106	8752	5
C108	8627	022 uF
R101	201	470
R102	201	220 K
S101 A-D	17807	SWITCH, ROTARY
T101	18592	TRANSFORMER
T102	18601	TRANSFORMER
T103	18605	TRANSFORMER
V101	TYPE 5899	VACUUM TUBE
Z101	17890	LOOP AMP. ASSEM.

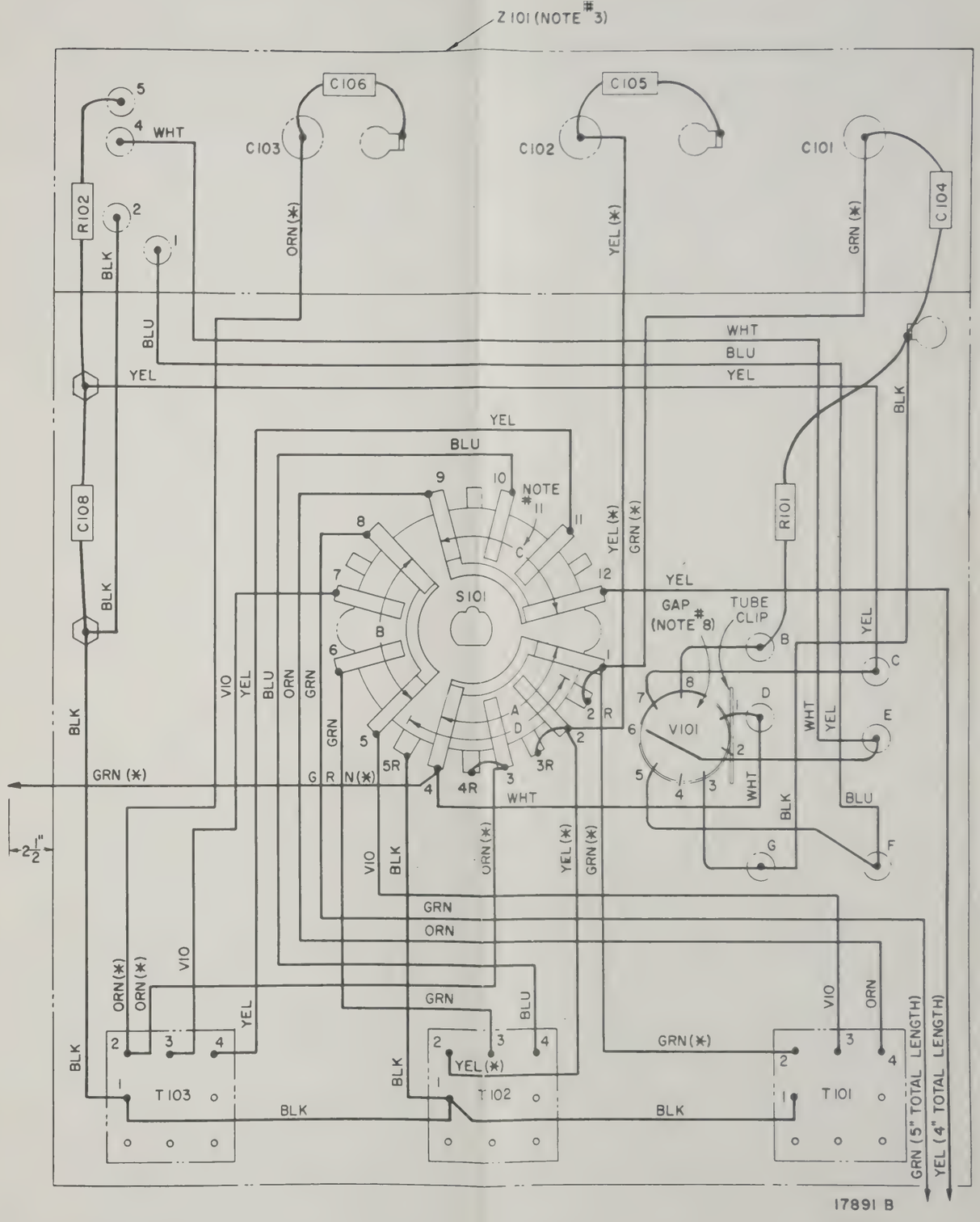
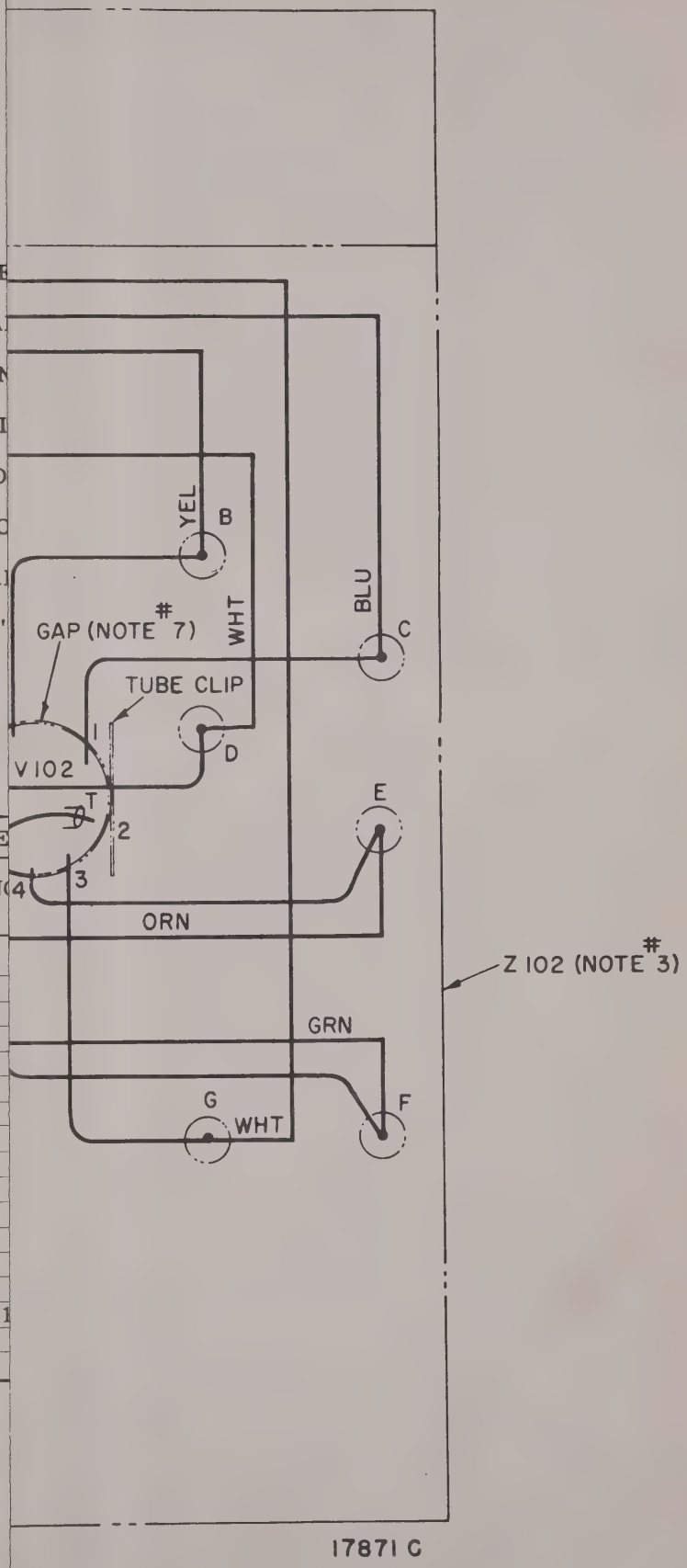


Figure 6–3. Receiver Type R-30, Loop Unit, Wiring Diagram

NOTES:

1. INSTALL TEFLON IMPREGNATED FIBE
2. FOR ASSOCIATED SCHEMATIC DIAGRA
3. FOR ASSOCIATED MAIN CHASSIS WIRIN
4. RESISTANCE VALUES IN TABLE ARE I
5. CAPACITANCE VALUES ARE IN MICRO
6. ALL WIRES MARKED WITH COLOR NC
7. ELECTRON TUBE V102 VIEWED TOWA
8. DRESS BARE TUBE LEADS WITH 1/16"



SYMBOL IDE	
SYMBOL NO.	DRAWIN(NO.
C109	8706
C110	8706
C111	4520
C112	4520
C113	8746
C114	8706
R103	201
R104	201
R105	201
R106	201
R108	8739
R109	201
V102	TYPE 611
Z102	17870

Figure 6—4. Receiver Type R-30, Modulator Unit, Wiring Diagram

NOTES:

1. INSTALL TEFLON IMPREGNATED FIBERGLAS TUBING (.032"I.D.) OVER WIRE MARKED "T."
2. FOR ASSOCIATED SCHEMATIC DIAGRAM SEE FIGURE 6-1.
3. FOR ASSOCIATED MAIN CHASSIS WIRING DIAGRAM SEE FIGURE 6-2.
4. RESISTANCE VALUES IN TABLE ARE IN OHMS. MULTIPLIERS: K = 1,000; MEG = 1,000,000.
5. CAPACITANCE VALUES ARE IN MICROMICROFARADS (uuF) UNLESS OTHERWISE SPECIFIED.
6. ALL WIRES MARKED WITH COLOR NOTE ARE #24 SOLID COPPER, TEFLON INSULATED.
7. ELECTRON TUBE V102 VIEWED TOWARD BASE. ORIENT TUBE IN CLIP AS SHOWN.
8. DRESS BARE TUBE LEADS WITH 1/16" MIN. CLEARANCE.

SYMBOL IDENTIFICATION TABLE		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
C109	8706	150
C110	8706	510
C111	4520	100
C112	4520	100
C113	8746	0.8 uF
C114	8706	510
R103	201	47 K
R104	201	1.0 MEG
R105	201	330 K
R106	201	330 K
R108	8739	0-10 K (VARIABLE)
R109	201	22 K
V102	TYPE 6112	VACUUM TUBE
Z102	17870	MODULATOR ASSEMBLY

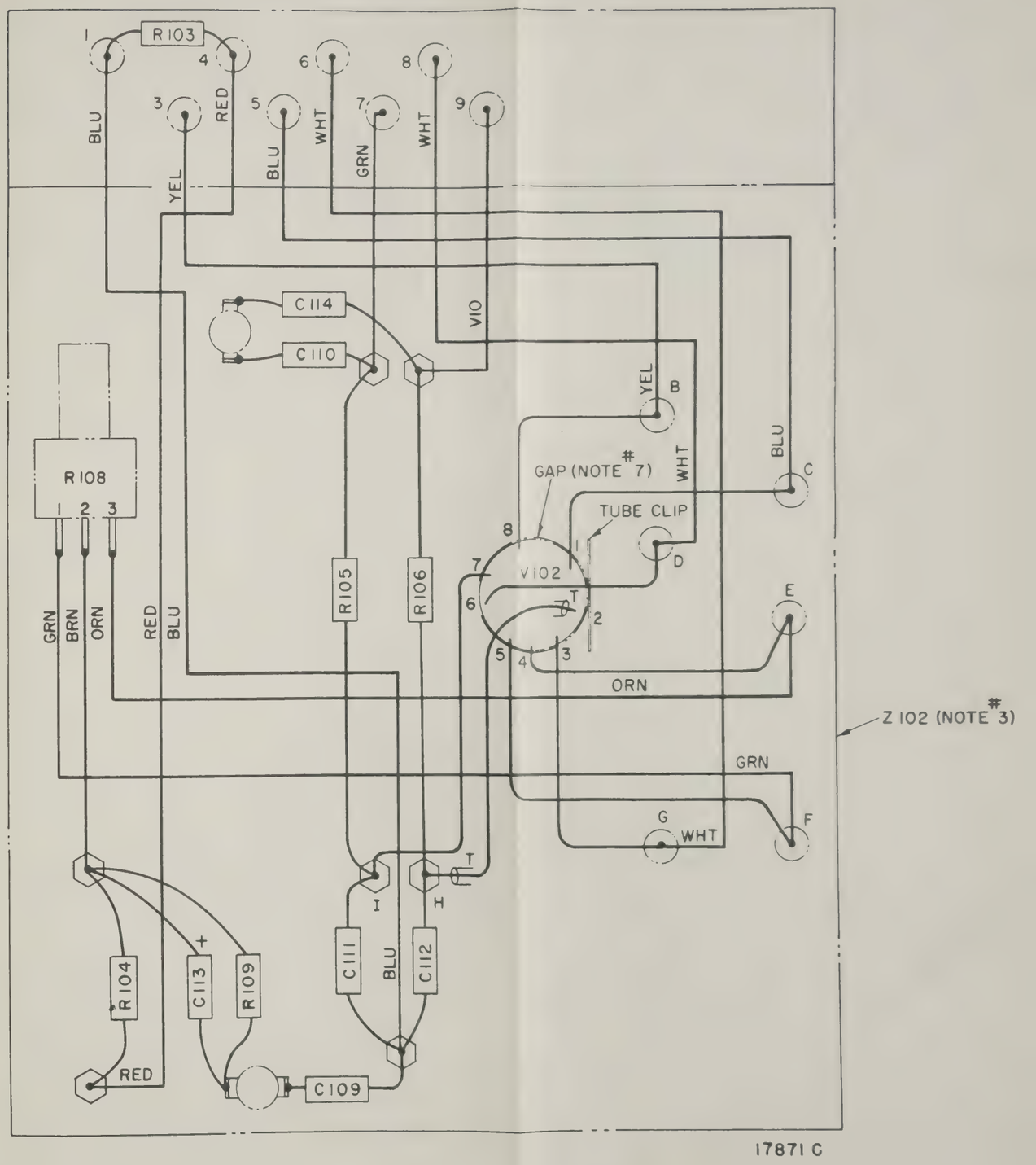


Figure 6—4. Receiver Type R-30, Modulator Unit, Wiring Diagram

NOTES:

1. SWITCH SECTION
S103):

SECTI
A
B
C
D

WIRED CONTACT

2. FOR ASSOCIATEI
3. FOR ASSOCIATEI
4. RESISTANCE VAI
5. CAPACITOR VAL
6. ALL WIRES MAR
7. ALL UNMARKED
8. COVER WIRE MA
9. DRESS ALL WIRE
FROM GROUND A
10. ELECTRON TUBE
11. DRESS BARE TUO
2 AND 4 APPROX
12. SOLDER ALL WI
FROM TERMINAI

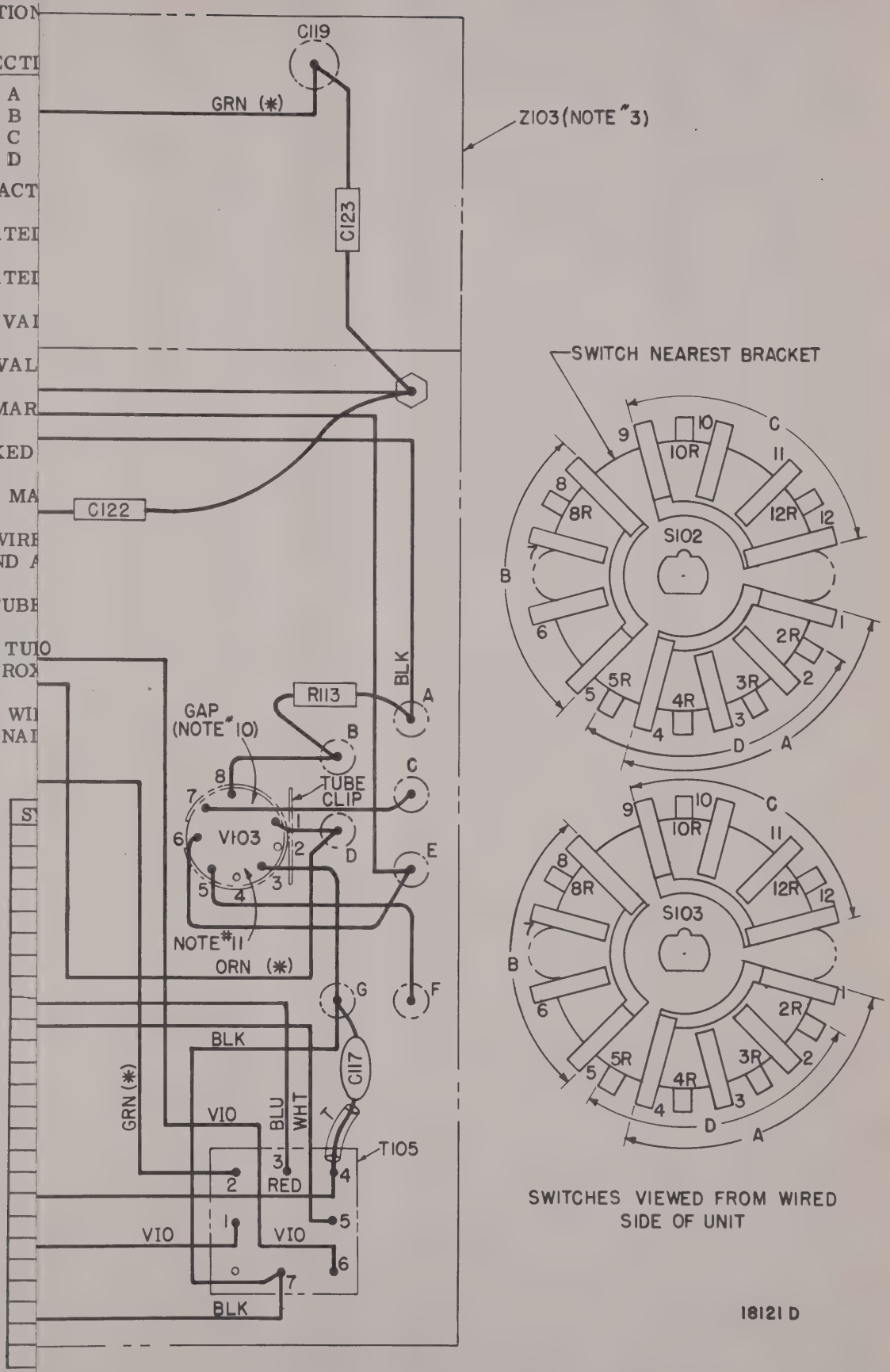


Figure 6–5. Receiver Type R-30, Antenna Unit, Wiring Diagram

NOTES:

1. SWITCH SECTIONS (TERMINAL GROUPS RELATED TO SECTIONS IDENTICALLY IN S102 AND S103):

SECTION	TERMINALS
A	1, 2, 3, 4
B	5, 6, 7, 8
C	9, 10, 11, 12
D	2R, 3R, 4R, 5R, 8R, 10R, 12R

WIRED CONTACTS ONLY ARE SHOWN IN MAIN DIAGRAM.

2. FOR ASSOCIATED SCHEMATIC DIAGRAM SEE FIGURE 6-1.
3. FOR ASSOCIATED MAIN CHASSIS WIRING DIAGRAM SEE FIGURE 6-2.
4. RESISTANCE VALUES ARE IN OHMS. MULTIPLIER: K = 1,000.
5. CAPACITOR VALUES ARE IN MICROMICROFARADS (μμF) UNLESS OTHERWISE SPECIFIED.
6. ALL WIRES MARKED WITH COLOR NOTE ARE #24 SOLID COPPER, TEFLON INSULATED.
7. ALL UNMARKED WIRES ARE #24 BARE TINNED SOLID COPPER.
8. COVER WIRE MARKED "T" WITH TEFLON IMPREGNATED FIBERGLAS TUBING (.032" I.D.).
9. DRESS ALL WIRES MARKED WITH AN ASTERISK (*) AS SHORT AS POSSIBLE AND FREE FROM GROUND AND OTHER WIRES.
10. ELECTRON TUBE V103 IS VIEWED TOWARD BASE. ORIENT TUBE IN CLIP AS SHOWN.
11. DRESS BARE TUBE LEADS WITH 1/16" MIN. CLEARANCE. CUT OFF UNUSED TUBE LEADS 2 AND 4 APPROX. 1/32" FROM GLASS.
12. SOLDER ALL WIRES TO TRANSFORMERS T105, T106, AND T107 WITH 1/16" MIN. CLEARANCE FROM TERMINAL PLATE.

SYMBOL IDENTIFICATION TABLE

SYMBOL NO.	DRAWING NO.	DESCRIPTION
C116	8627	.022 uF
C117	8627	.022 uF
C118	8760	7
C119	8743	3-12 (VARIABLE)
C120	8743	3-12 (VARIABLE)
C121	8743	3-12 (VARIABLE)
C122	8747	.047 uF
C123	8752	5
C152	8627	.022 uF
R111	201	10 K
R112	201	100 K
R113	201	470
R157	201	100
S102	17807	SWITCH, ROTARY
S103	17807	SWITCH, ROTARY
T105	18748	TRANSFORMER
T106	18752	TRANSFORMER
T107	18756	TRANSFORMER
V103	TYPE 5899	VACUUM TUBE
Z103	18120	ANTENNA UNIT ASSEMBLY

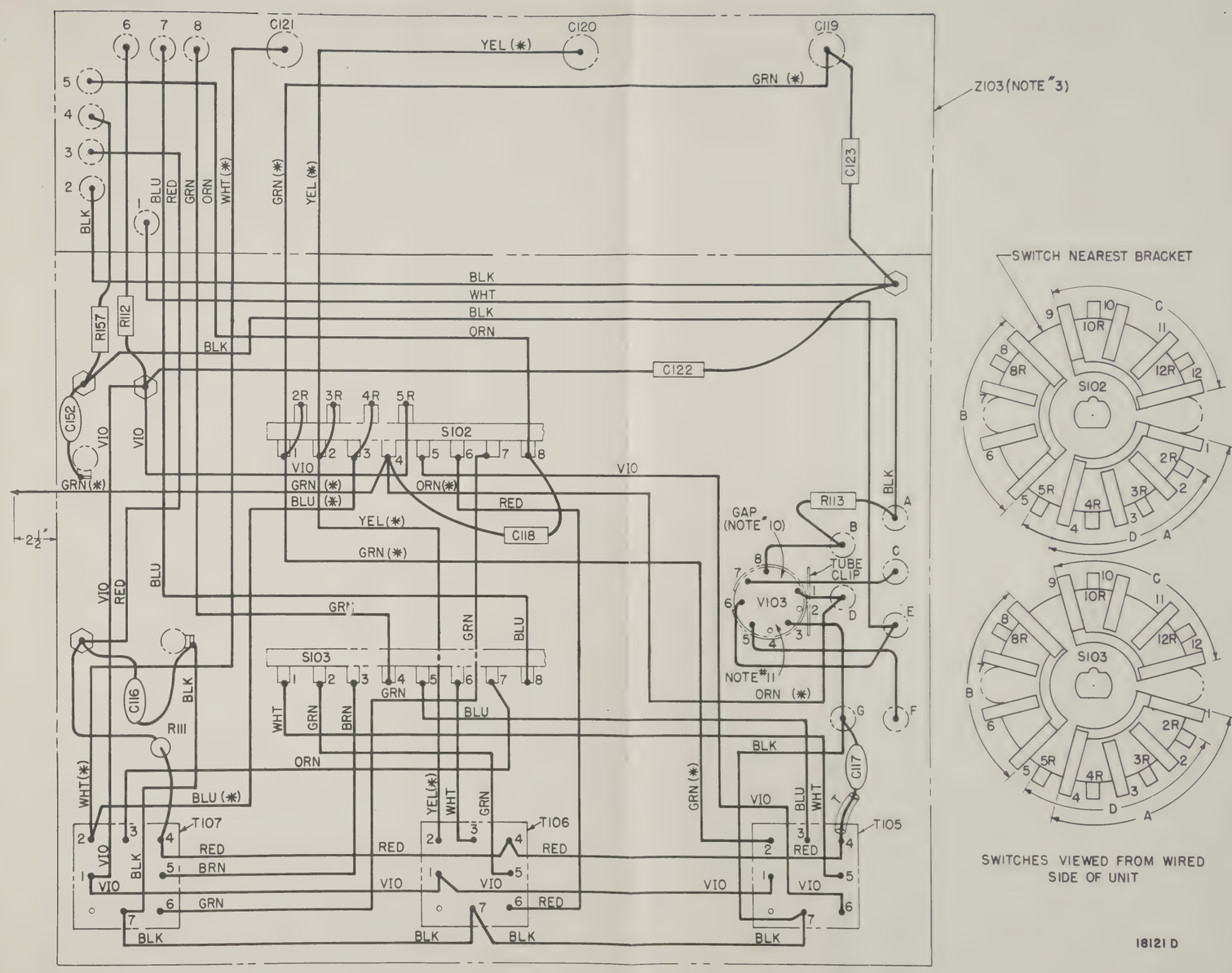


Figure 6—5. Receiver Type R-30, Antenna Unit, Wiring Diagram

NOTES:

1. ALL WIRES MARKED WITH AN ASTERISK
   FROM GROUND AND OTHER LEADS.
2. FOR ASSOCIATED SCHEMATIC DIAGRAM
3. FOR ASSOCIATED MAIN CHASSIS WIRING
4. ALL RESISTANCE VALUES ARE IN OHMS.
5. CAPACITANCE VALUES ARE IN MICROMI
6. ALL WIRES MARKED WITH COLOR NOTE
7. ALL UNMARKED WIRES ARE #24 BARE S
8. SOLDER ALL WIRES TO TRANSFORMERS
   CLEARANCE FROM TERMINAL PLATE.
9. SWITCH SECTIONS:

SECTION	TERMINA
S104A	1, 2, 3, 4
S104B	5, 6, 7, 8
S104C	9, 10, 11,
S104D	2R, 3R, 4

SYMBOL IDENT	
SYMBOL NO.	DRAWING NO.
C124	8627
C125	8743
C126	8743
C127	8743
C128	8769
R114	201
R115	201
S104A-D	17807
T108	18609
T109	18613
T110	18617
Z104	17810

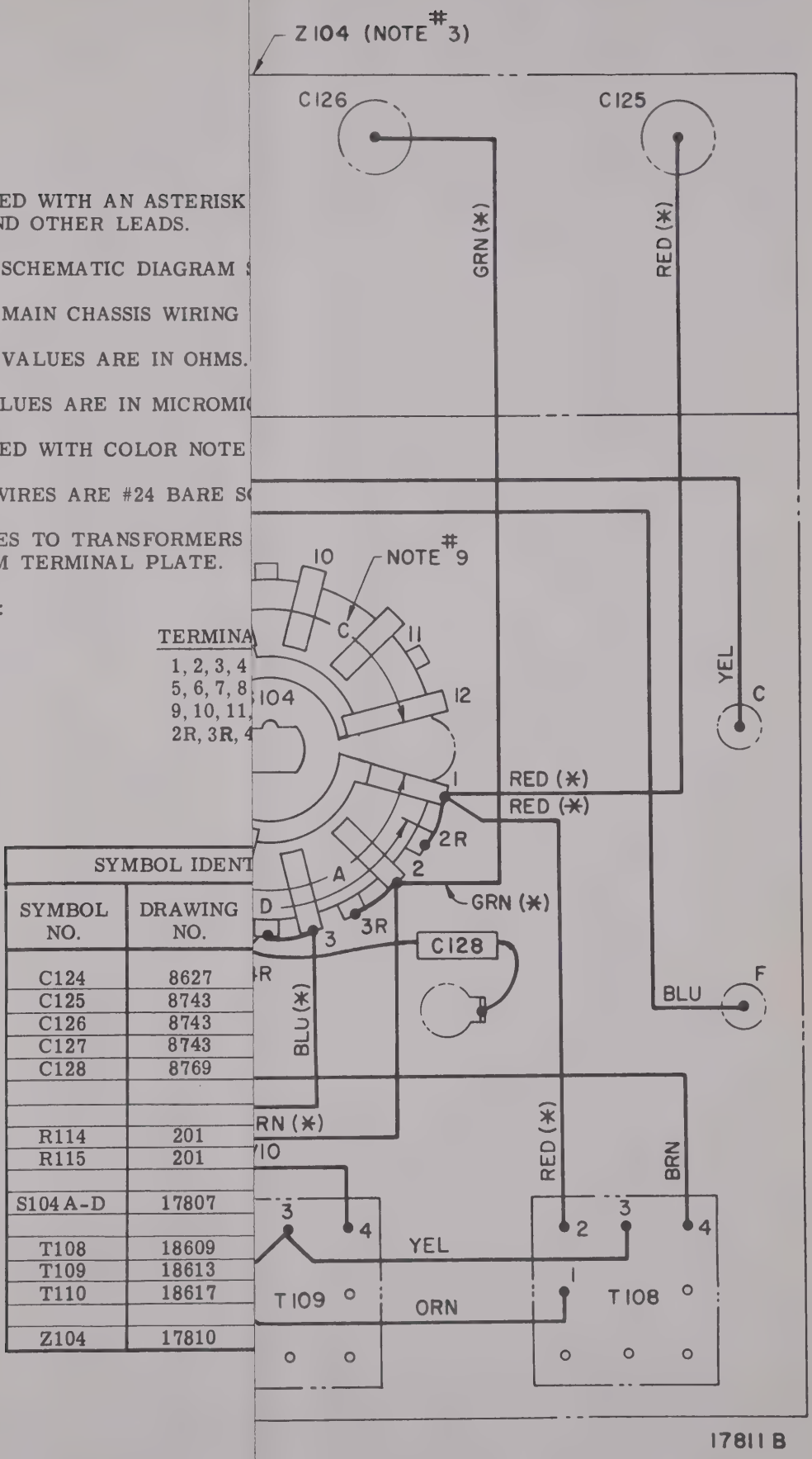


Figure 6—6. Receiver Type R-30, First R-F Unit, Wiring Diagram

NOTES:

1. ALL WIRES MARKED WITH AN ASTERISK (*) SHALL BE AS SHORT AS POSSIBLE AND FREE FROM GROUND AND OTHER LEADS.
2. FOR ASSOCIATED SCHEMATIC DIAGRAM SEE FIGURE 6-1.
3. FOR ASSOCIATED MAIN CHASSIS WIRING DIAGRAM SEE FIGURE 6-2.
4. ALL RESISTANCE VALUES ARE IN OHMS. MULTIPLIER: K = 1,000.
5. CAPACITANCE VALUES ARE IN MICROMICROFARADS (μμF) UNLESS OTHERWISE SPECIFIED.
6. ALL WIRES MARKED WITH COLOR NOTE ARE #24 SOLID COPPER, TEFLON INSULATED.
7. ALL UNMARKED WIRES ARE #24 BARE SOLID TINNED COPPER.
8. SOLDER ALL WIRES TO TRANSFORMERS T108, T109, AND T110 WITH 1/16" MIN. CLEARANCE FROM TERMINAL PLATE.
9. SWITCH SECTIONS:

SECTION	TERMINALS
S104A	1, 2, 3, 4
S104B	5, 6, 7, 8
S104C	9, 10, 11, 12
S104D	2R, 3R, 4R, 5R

SYMBOL IDENTIFICATION TABLE		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
C124	8627	.022 uF
C125	8743	3-12 (VARIABLE)
C126	8743	3-12 (VARIABLE)
C127	8743	3-12 (VARIABLE)
C128	8769	24
R114	201	100 K
R115	201	4700
S104 A-D	17807	SWITCH, ROTARY
T108	18609	TRANSFORMER
T109	18613	TRANSFORMER
T110	18617	TRANSFORMER
Z104	17810	1ST RF UNIT ASSEMBLY

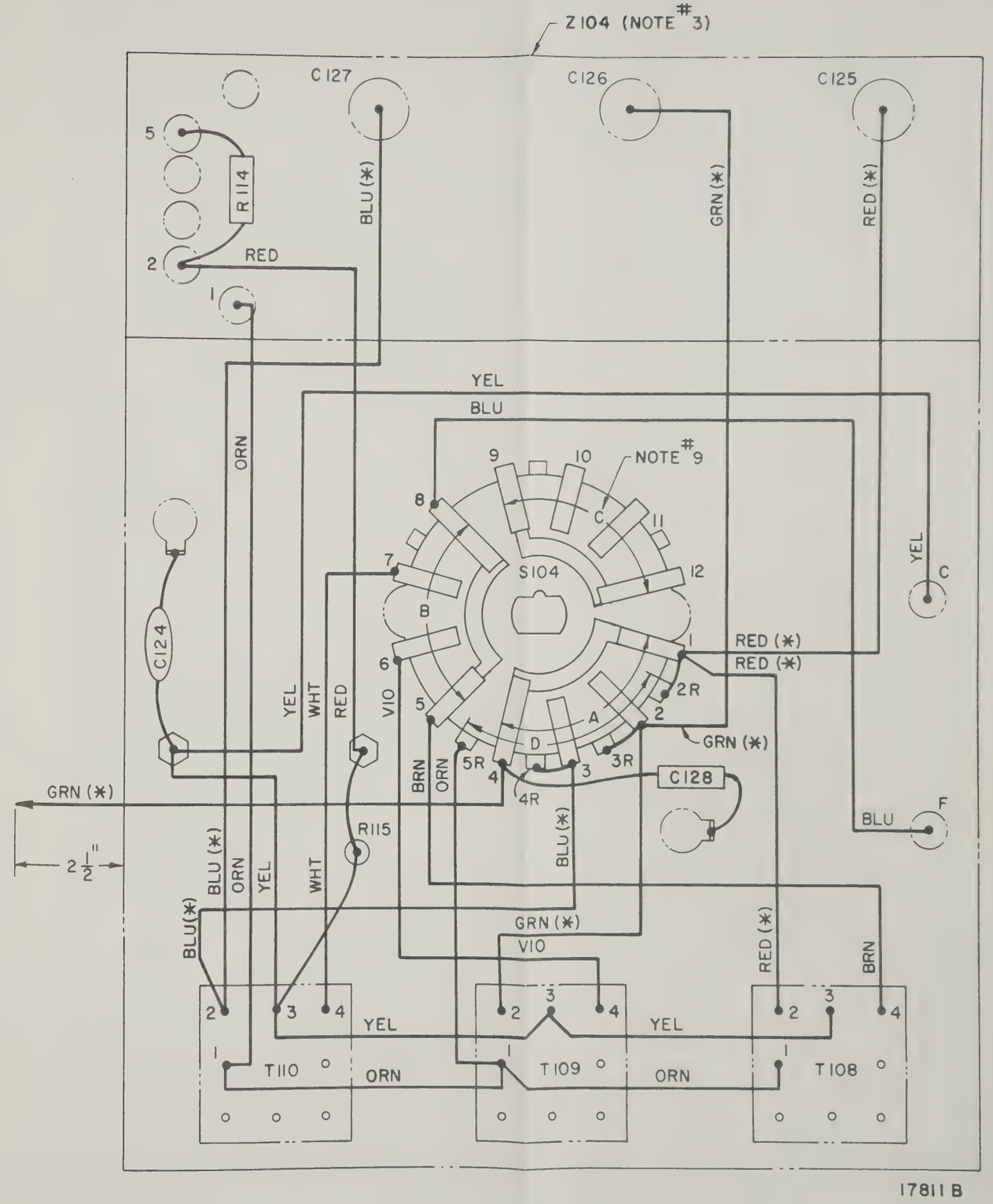


Figure 6—6. Receiver Type R-30, First R-F Unit, Wiring Diagram

NOTES:

1. ALL WIRES MARKED WITH AN AST
   FROM GROUND AND OTHER LEADS
2. FOR ASSOCIATED SCHEMATIC DIAG
3. FOR ASSOCIATED MAIN CHASSIS WI
4. CAPACITOR VALUES ARE IN MICRO
5. ALL WIRES MARKED WITH COLOR
6. ALL UNMARKED WIRES ARE #24 BA
7. DRESS ALL WIRES TO TRANSFORM
   FROM TERMINAL PLATE.
8. SWITCH SECTIONS:

SECTION	TE
S105A	1,
S105B	5,
S105C	9,
S105D	2

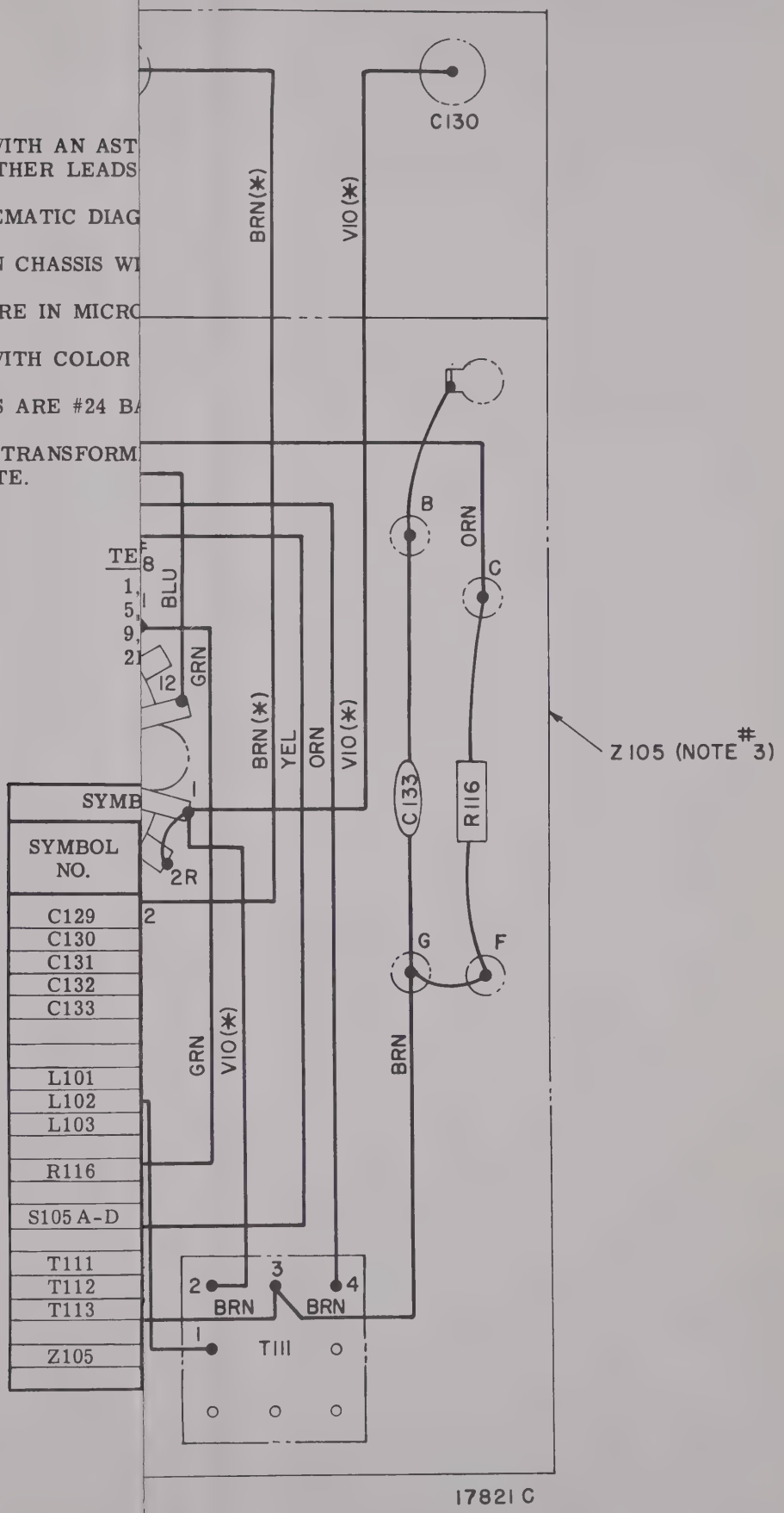


Figure 6–7.
Receiver Type R-30, Second R-F Unit, Wiring Diagram

NOTES:

1. ALL WIRES MARKED WITH AN ASTERISK (*) SHALL BE AS SHORT AS POSSIBLE AND FREE FROM GROUND AND OTHER LEADS.
2. FOR ASSOCIATED SCHEMATIC DIAGRAM SEE FIGURE 6-1.
3. FOR ASSOCIATED MAIN CHASSIS WIRING DIAGRAM SEE FIGURE 6-2.
4. CAPACITOR VALUES ARE IN MICROMICROFARADS (μμF) UNLESS OTHERWISE SPECIFIED.
5. ALL WIRES MARKED WITH COLOR NOTE ARE #24 SOLID COPPER, TEFLON INSULATED.
6. ALL UNMARKED WIRES ARE #24 BARE, SOLID TINNED COPPER.
7. DRESS ALL WIRES TO TRANSFORMERS T111, T112, AND T113 WITH 1/16" MIN. CLEARANCE FROM TERMINAL PLATE.
8. SWITCH SECTIONS:

SECTION	TERMINALS
S105A	1, 2, 3, 4
S105B	5, 6, 7, 8
S105C	9, 10, 11, 12
S105D	2R, 3R, 4R, 5R

SYMBOL IDENTIFICATION TABLE		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
C129	8769	20
C130	8743	3-12 (VARIABLE)
C131	8743	3-12 (VARIABLE)
C132	8743	3-12 (VARIABLE)
C133	8627	.022 uF
L101	15174	14 uH
L102	14141	3 uH
L103	15406	1 uH
R116	201	100,000 OHMS
S105 A-D	17807	SWITCH, ROTARY
T111	18609	TRANSFORMER
T112	18613	TRANSFORMER
T113	18617	TRANSFORMER
Z105	17820	RF UNIT ASSEMBLY

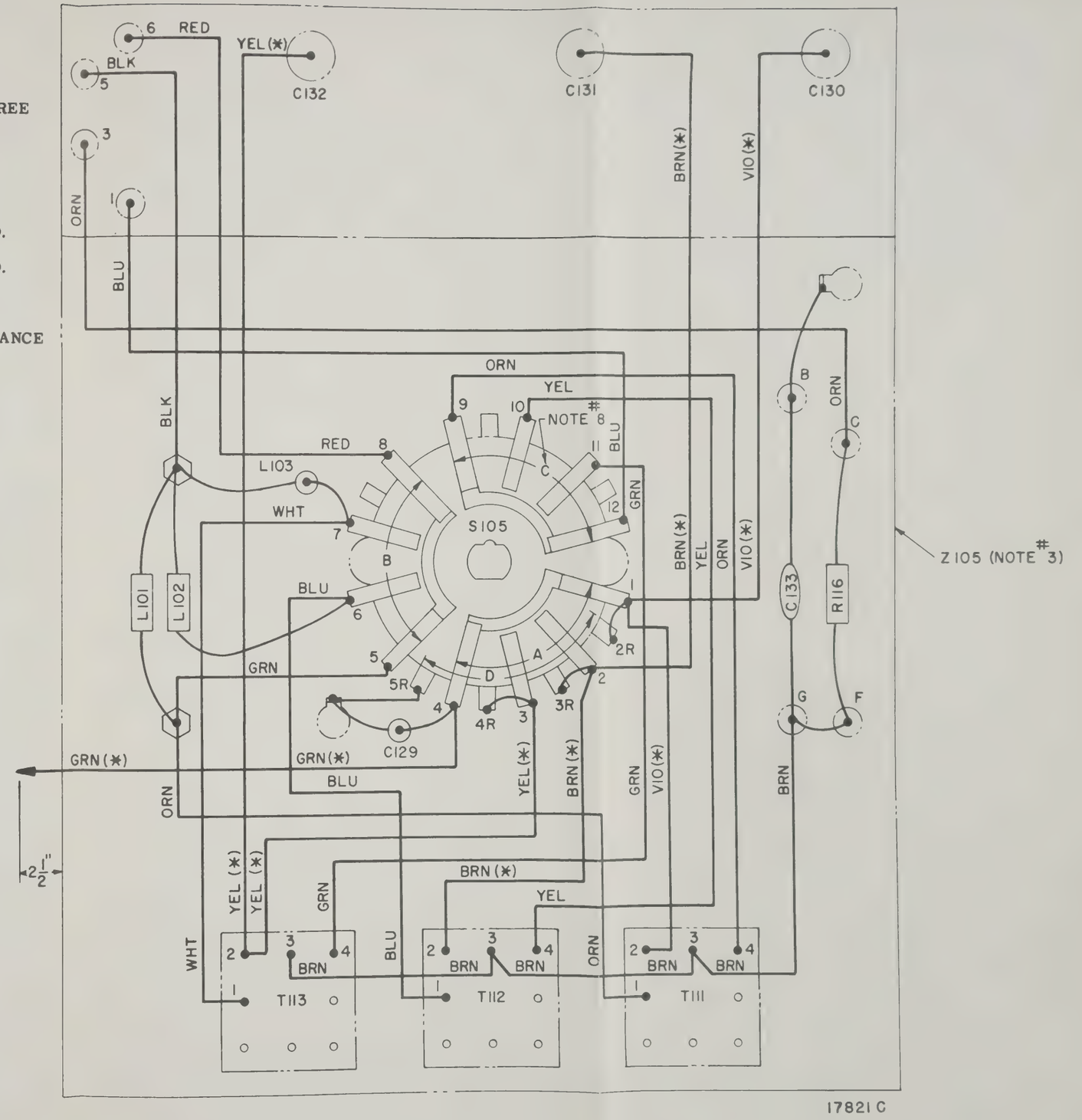


Figure 6—7.
Receiver Type R-30, Second R-F Unit, Wiring Diagram

NOTES:

1. SWITCH SECTIONS:

SECTION	TERMINALS
S106A	1, 2, 3, 4
S106B	5, 6, 7, 8
S106C	9, 10, 11, 12
S106D	2R, 3R, 4R, 5R

2. FOR ASSOCIATED SCHEMATIC DIAGRAM SEE F
3. FOR ASSOCIATED MAIN CHASSIS WIRING DIAGF
4. RESISTANCE VALUES ARE IN OHMS. MULTIPL
5. CAPACITANCE VALUES ARE IN MICROMICROFA
6. ALL WIRES MARKED WITH COLOR NOTE ARE ALL WIRES MARKED WITH AN ASTERISK (*) SH FROM GROUND AND OTHER LEADS.
7. ALL UNMARKED WIRES ARE #24 BARE, SOLID
8. INSTALL TEFLON IMPREGNATED FIBERGLAS (
9. DRESS BARE TUBE LEADS WITH 1/16" MIN. C AND 7 APPROX. 1/32" FROM GLASS.
10. ELECTRON TUBE V104 VIEWED TOWARD BASE

SYMBOL IDENTIFICA

SYMBOL NO.	DRAWING NO.	
C134	8706	
C135	8747	
C136	8746	
C137	8749	
C138	8223	
C139	8748	
C140	8618	
C141	8743	
C142	8743	
C143	8743	
C144	8750	
R117	201	
R118	201	
R119	201	
S106	17807	SV
T114	18621	T
T115	18625	T
T116	18629	T
V104	TYPE 5718	V
Z106	17910	OSCI

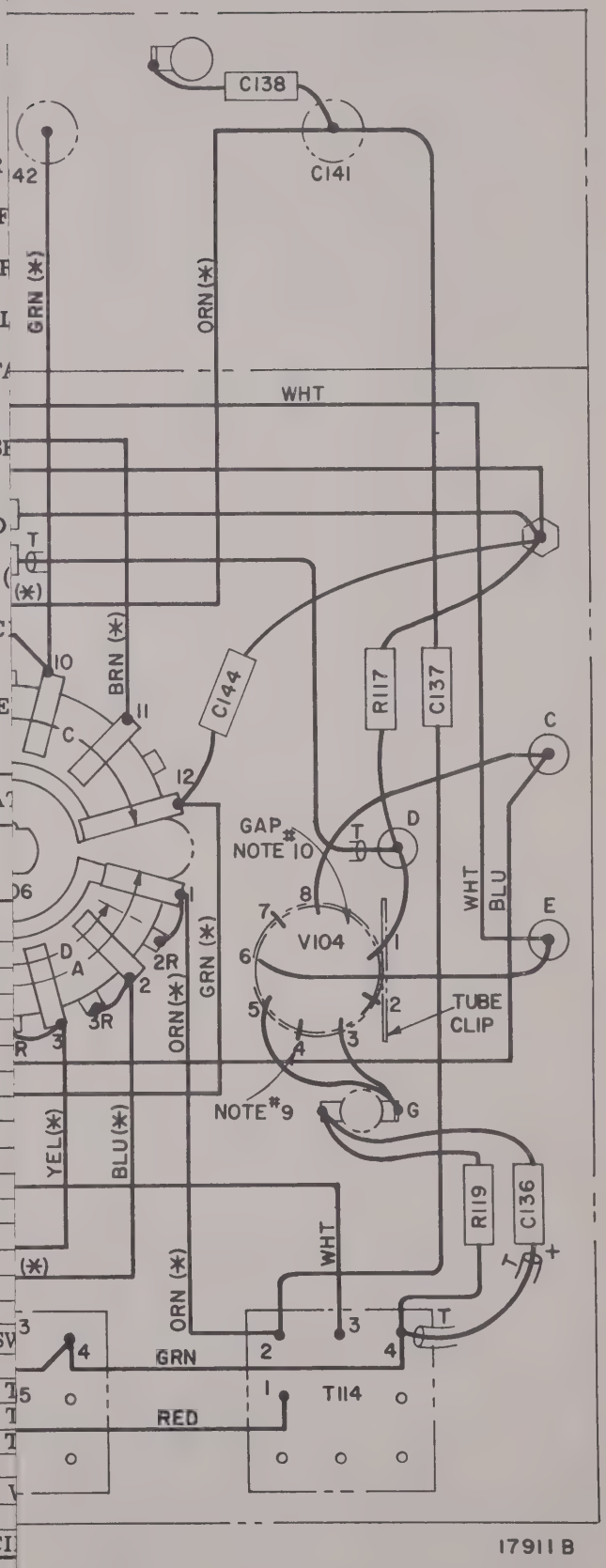


Figure 6–8. Receiver Type R-30, Oscillator Unit, Wiring Diagram

NOTES:

1. SWITCH SECTIONS:

SECTION	TERMINALS
S106A	1, 2, 3, 4
S106B	5, 6, 7, 8
S106C	9, 10, 11, 12
S106D	2R, 3R, 4R, 5R

2. FOR ASSOCIATED SCHEMATIC DIAGRAM SEE FIGURE 6-1.
3. FOR ASSOCIATED MAIN CHASSIS WIRING DIAGRAM SEE FIGURE 6-2.
4. RESISTANCE VALUES ARE IN OHMS. MULTIPLIER: K = 1,000.
5. CAPACITANCE VALUES ARE IN MICROMICROFARADS (μμF) UNLESS OTHERWISE SPECIFIED.
6. ALL WIRES MARKED WITH COLOR NOTE ARE #24 SOLID COPPER, TEFLON INSULATED. ALL WIRES MARKED WITH AN ASTERISK (*) SHALL BE AS SHORT AS POSSIBLE AND FREE FROM GROUND AND OTHER LEADS.
7. ALL UNMARKED WIRES ARE #24 BARE, SOLID TINNED COPPER.
8. INSTALL TEFLON IMPREGNATED FIBERGLAS (.032" I.D.) OVER WIRES MARKED "T."
9. DRESS BARE TUBE LEADS WITH 1/16" MIN. CLEARANCE. CUT OFF UNUSED LEADS 2, 4, AND 7 APPROX. 1/32" FROM GLASS.
10. ELECTRON TUBE V104 VIEWED TOWARD BASE. ORIENT TUBE IN CLIP AS SHOWN.

SYMBOL IDENTIFICATION TABLE		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
C134	8706	220
C135	8747	.047 uF
C136	8746	0.8 uF
C137	8749	369
C138	8223	5
C139	8748	757
C140	8618	1800
C141	8743	3-12 (VARIABLE)
C142	8743	3-12 (VARIABLE)
C143	8743	3-12 (VARIABLE)
C144	8750	12
R117	201	100 K
R118	201	10 K
R119	201	2.2 K
S106	17807	SWITCH, ROTARY
T114	18621	TRANSFORMER
T115	18625	TRANSFORMER
T116	18629	TRANSFORMER
V104	TYPE 5718	VACUUM TUBE
Z106	17910	OSCILLATOR ASSEMBLY

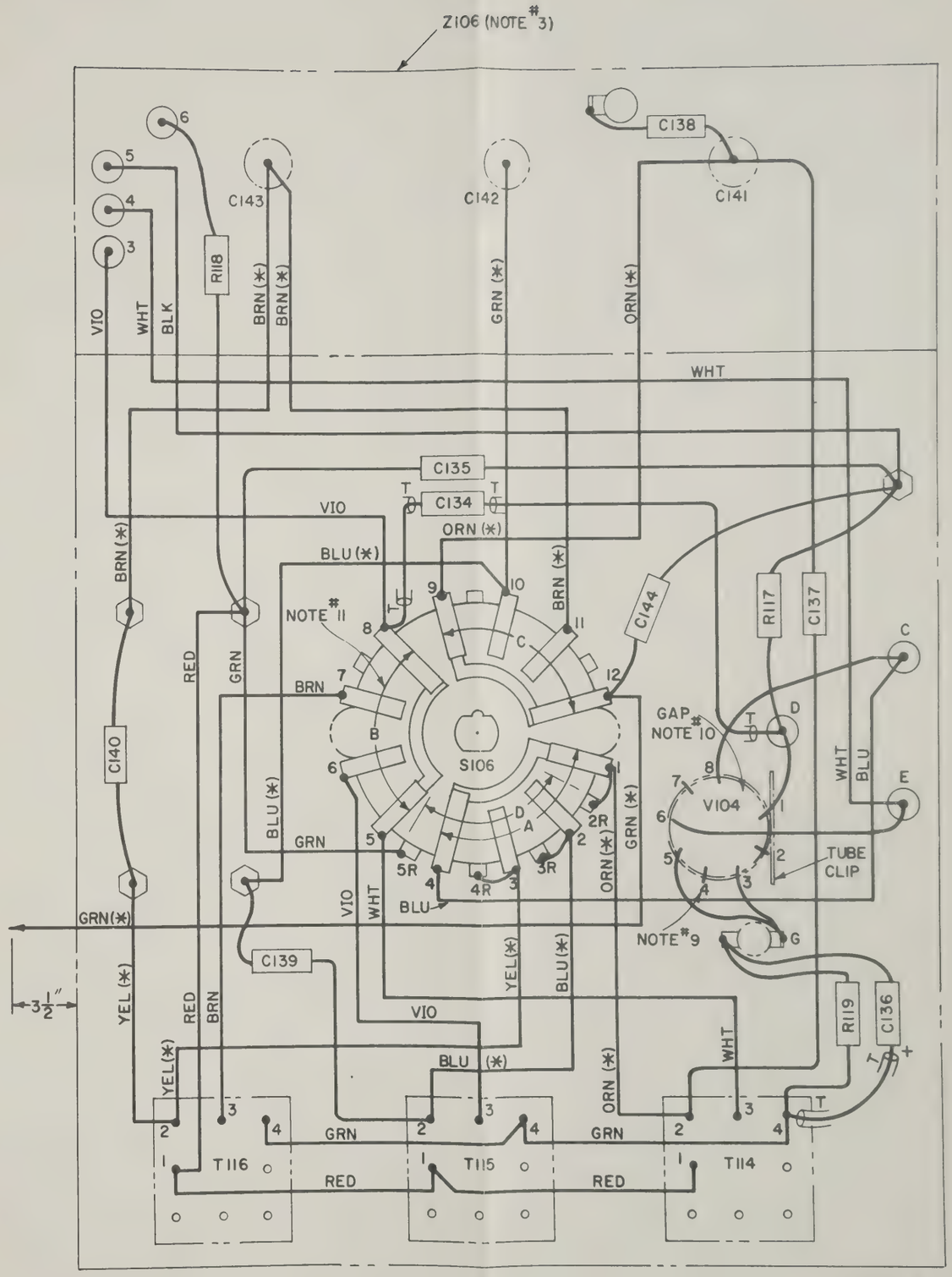
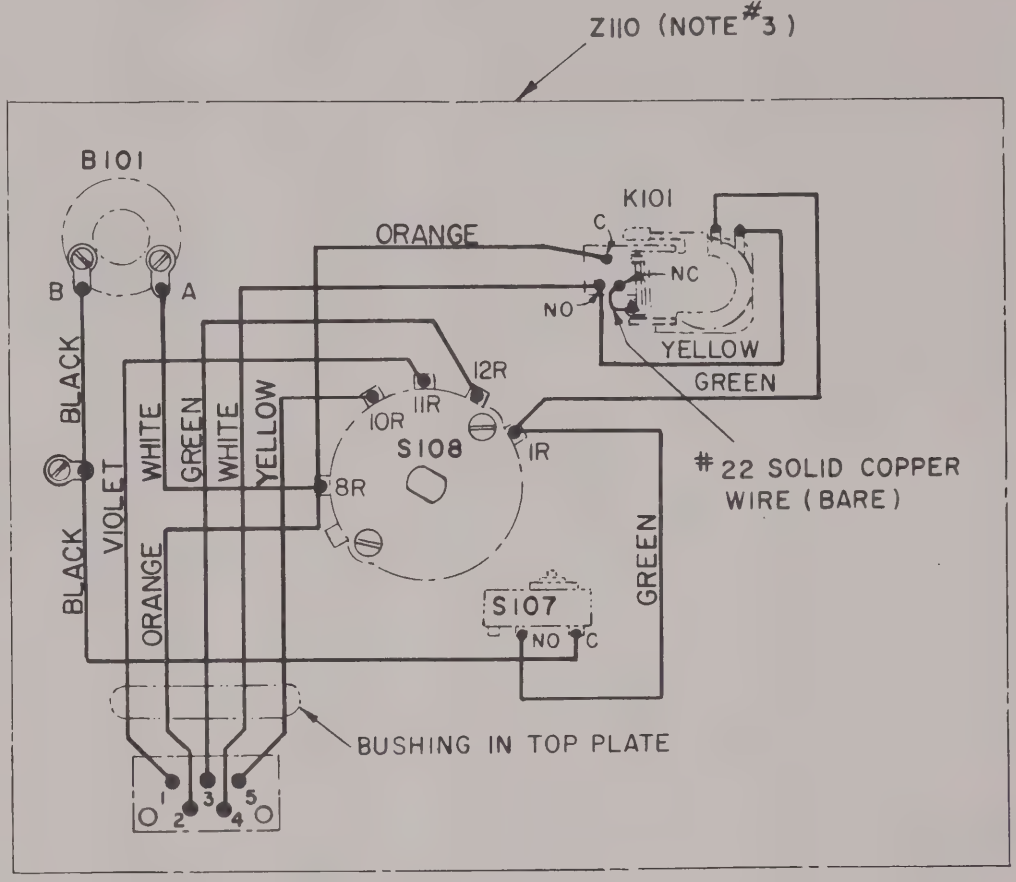
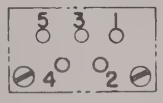


Figure 6—8. Receiver Type R-30, Oscillator Unit, Wiring Diagram





OUTSIDE VIEW
TERMINAL PLATE

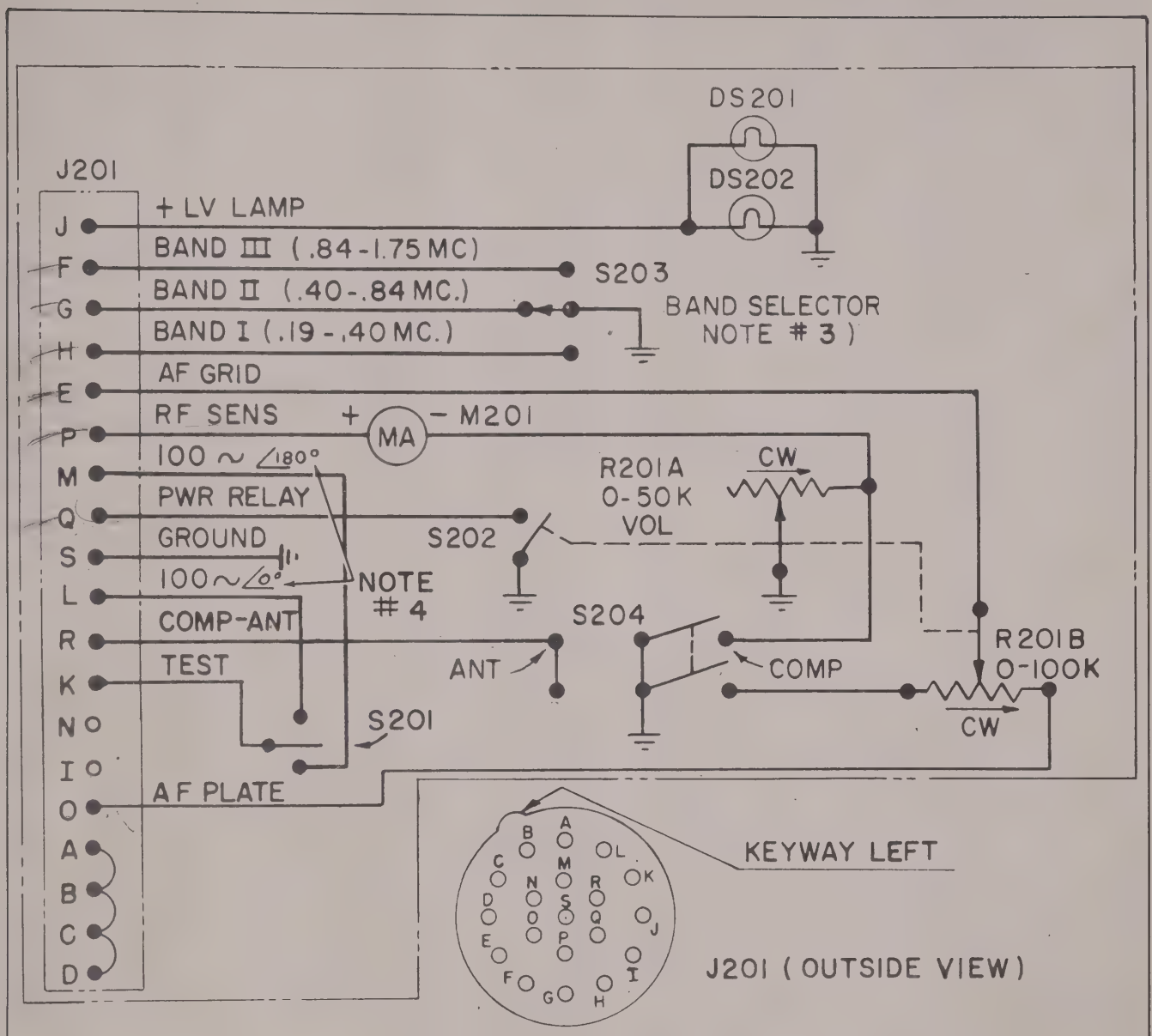
SYMBOL IDENTIFICATION TABLE		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
K101	14403	RELAY (14V)
	14404	RELAY (28V)
B101	18800	MOTOR (14V)
	18801	MOTOR (28V)
S107	8685	MICRO SWITCH
S108	17924	ROTARY SWITCH

NOTES:

1. ALL WIRES MARKED WITH COLOR CODE ARE #24 SOLID COPPER TEFLON INSULATED.
2. FOR ASSOCIATED SCHEMATIC DIAGRAM SEE FIGURE 6-1.
3. FOR ASSOCIATED MAIN CHASSIS WIRING DIAGRAM SEE FIGURE 6-2.

17931 A

Figure 6–9. Receiver Type R-30, Band Selector, Wiring Diagram



NOTES:

1. FOR WIRING DIAGRAM SEE FIGURE 6-11.
2. RESISTANCE VALUES ARE IN OHMS. MULTIPLIER: K = 1,000.
3. S203, SWITCH, MECHANICALLY LINKED TO SHIELD WHICH CHANGES DIAL SCALE PRESENTATION.
4. FIRST ANGLES GIVEN ARE FOR BELLY SENSE ANTENNA, SECOND ANGLES ARE FOR TOP SENSE ANTENNA.

17982 C

Figure 6–10. Control Unit Type C-59, Schematic Diagram

NOTES:

1. INSTALL TRANSPARENT VINYLITE TUBING O
   OR GROUPS OF WIRES MARKED "T."
2. FOR SCHEMATIC DIAGRAM SEE FIGURE 6-10.
3. ALL WIRES MARKED WITH COLOR NOTE ARE
4. ALL UNMARKED WIRES ARE BARE #22 SOLID

SYMBOL IDENTIFICATION MULTIPLIER FOR RESISTAN K = 1,000		
SYMBOL NO.	DRAWING NO.	DES
J201	12357	RECI
DS201	8622	LA
	8679	LA
DS202	8622	LA
	8679	LA
R201A	8776	0-5(
R201B		0-1(
M201	18428	0
S201	13139	S
S202	PART OF 8776	S
S203	PART OF 18480	S
S204	8085	S
XDS201	16293	PAN
XDS202	16293	PAN

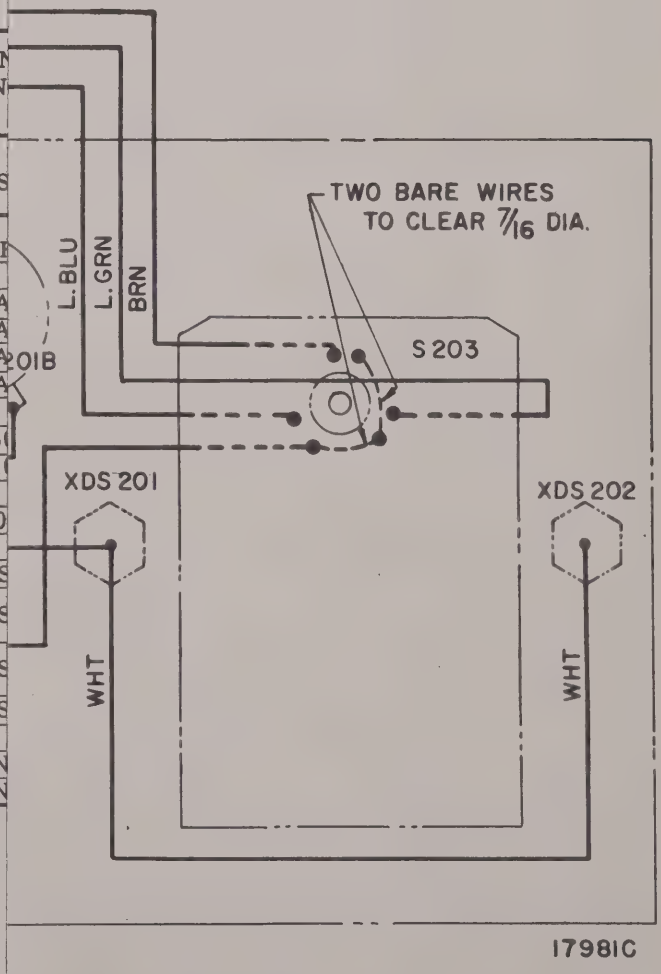
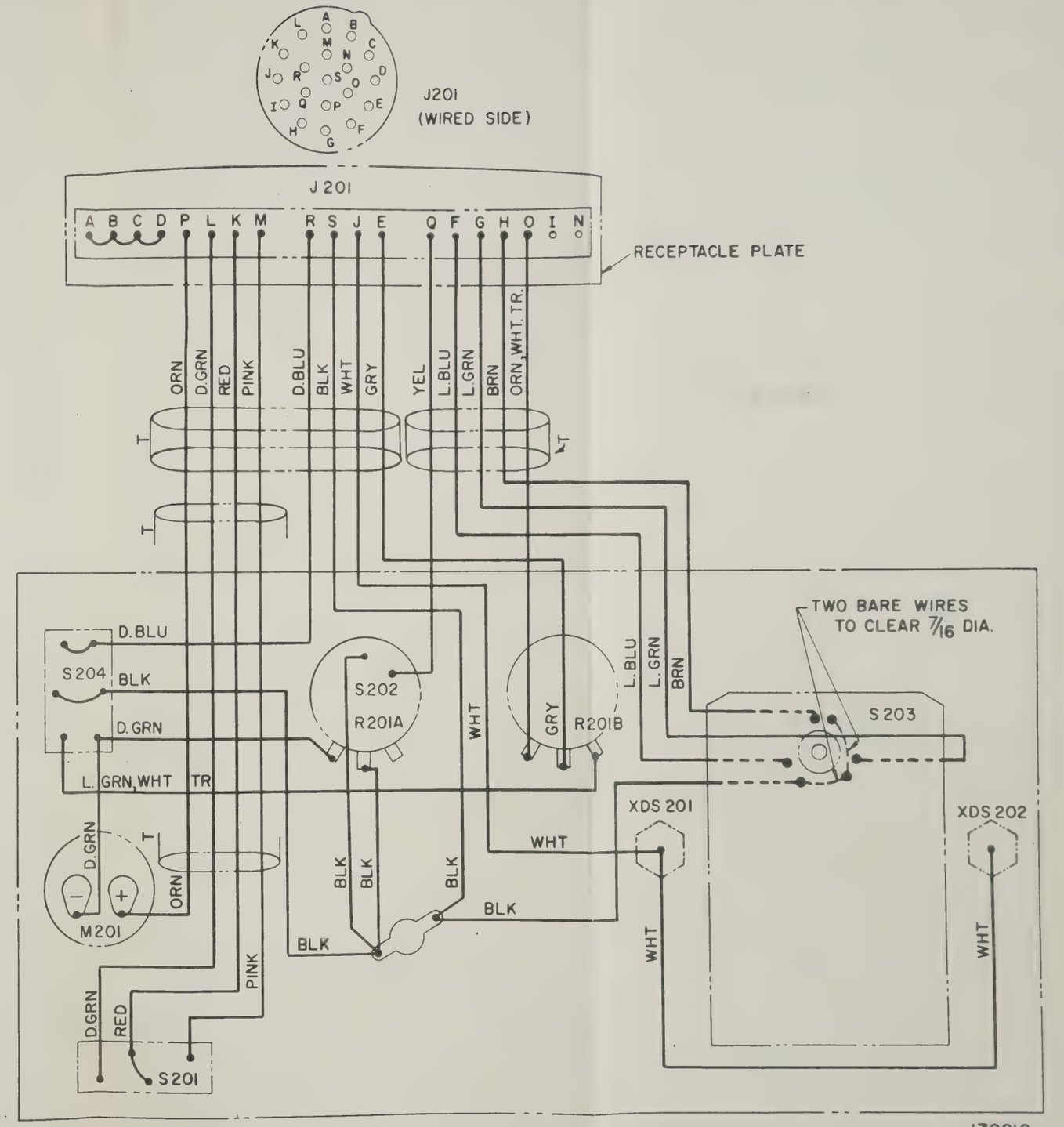


Figure 6—11. Control Unit Type C-59, Wiring Diagram

NOTES:

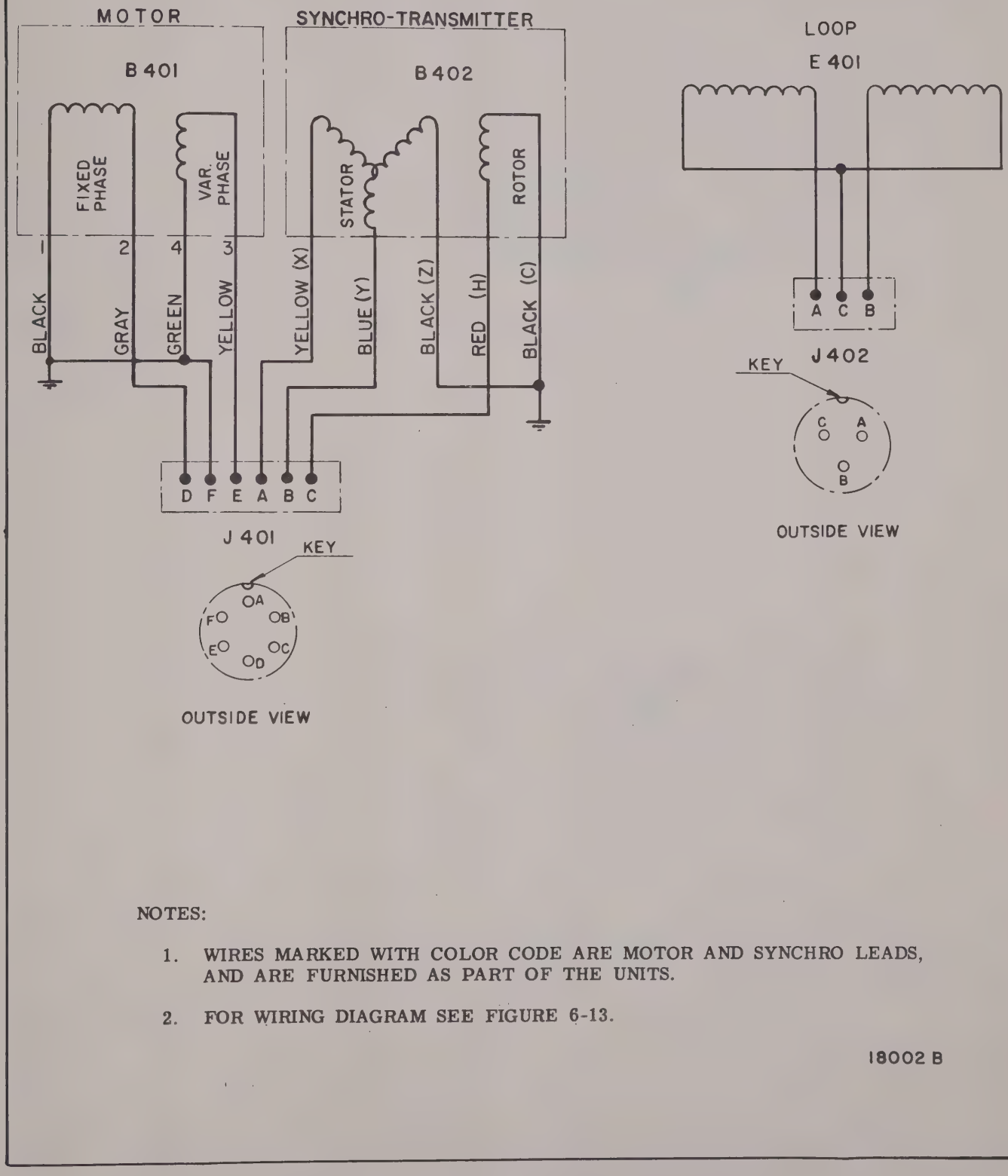
1. INSTALL TRANSPARENT VINYLITE TUBING OF APPROPRIATE SIZE OVER WIRES OR GROUPS OF WIRES MARKED "T."
2. FOR SCHEMATIC DIAGRAM SEE FIGURE 6-10.
3. ALL WIRES MARKED WITH COLOR NOTE ARE #22 STRANDED COPPER.
4. ALL UNMARKED WIRES ARE BARE #22 SOLID TINNED COPPER.

SYMBOL IDENTIFICATION TABLE MULTIPLIER FOR RESISTANCE VALUES: K = 1,000		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
J201	12357	RECEPT.(19 PIN)
DS201	8622	LAMP (28V)
	8679	LAMP (14V)
DS202	8622	LAMP (28V)
	8679	LAMP (14V)
R201A	8776	0-50 K (VAR)
R201B		0-100K (VAR)
M201	18428	0-15 MA.
S201	13139	SWITCH
S202	PART OF 8776	SWITCH
S203	PART OF 18480	SWITCH
S204	8085	SWITCH
XDS201	16293	PANEL LIGHT
XDS202	16293	PANEL LIGHT



VIEW TOWARD REAR OF FRONT PANEL

Figure 6–11. Control Unit Type C-59, Wiring Diagram



NOTES:

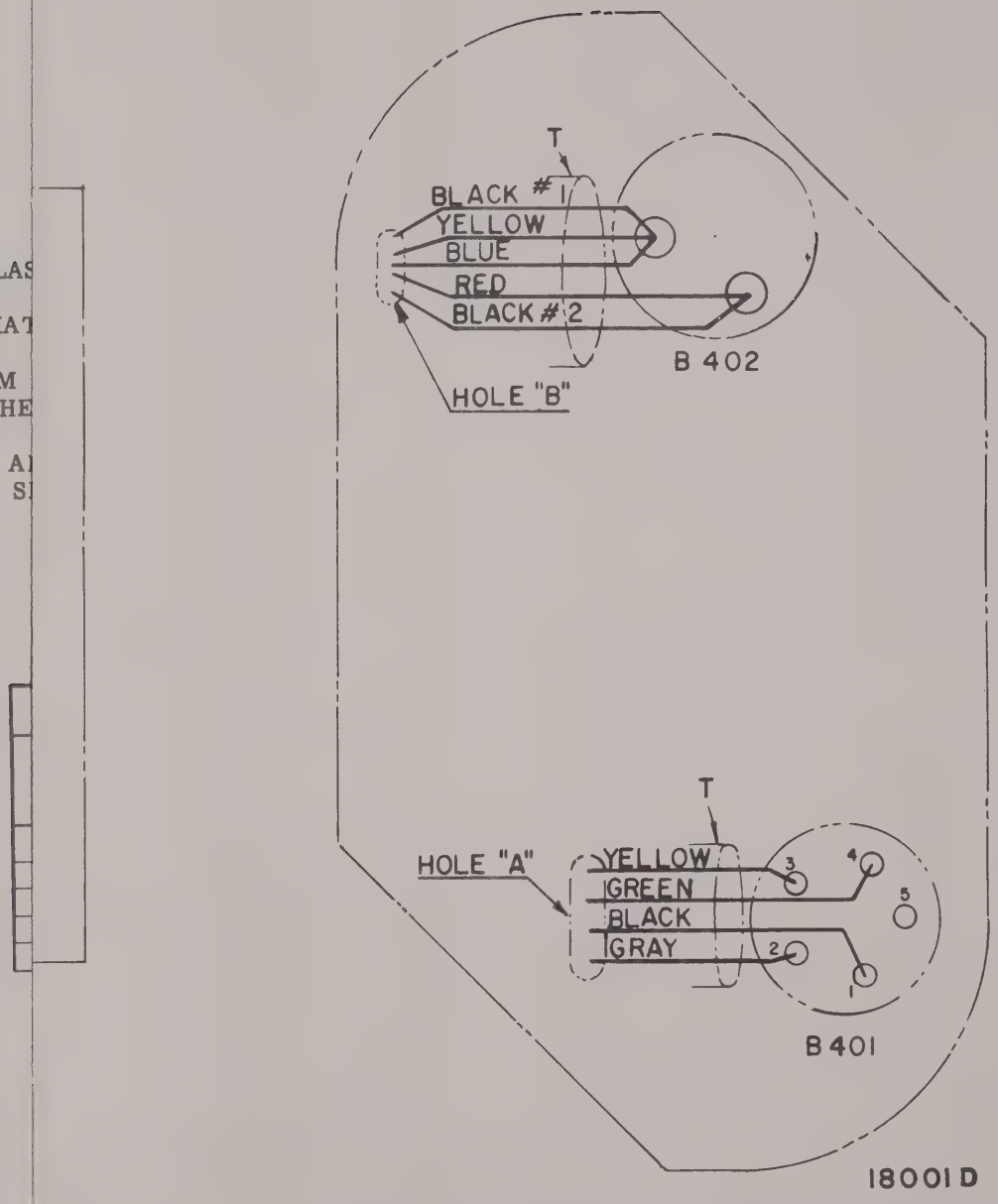
1. WIRES MARKED WITH COLOR CODE ARE MOTOR AND SYNCHRO LEADS, AND ARE FURNISHED AS PART OF THE UNITS.
2. FOR WIRING DIAGRAM SEE FIGURE 6-13.

18002 B

Figure 6—12. Loop Type L-11, Schematic Diagram

NOTES:

1. INSTALL PLAS
2. FOR SCHEMAT
3. WIRES FROM PART OF THE
4. ALL WIRES A OTHERWISE S



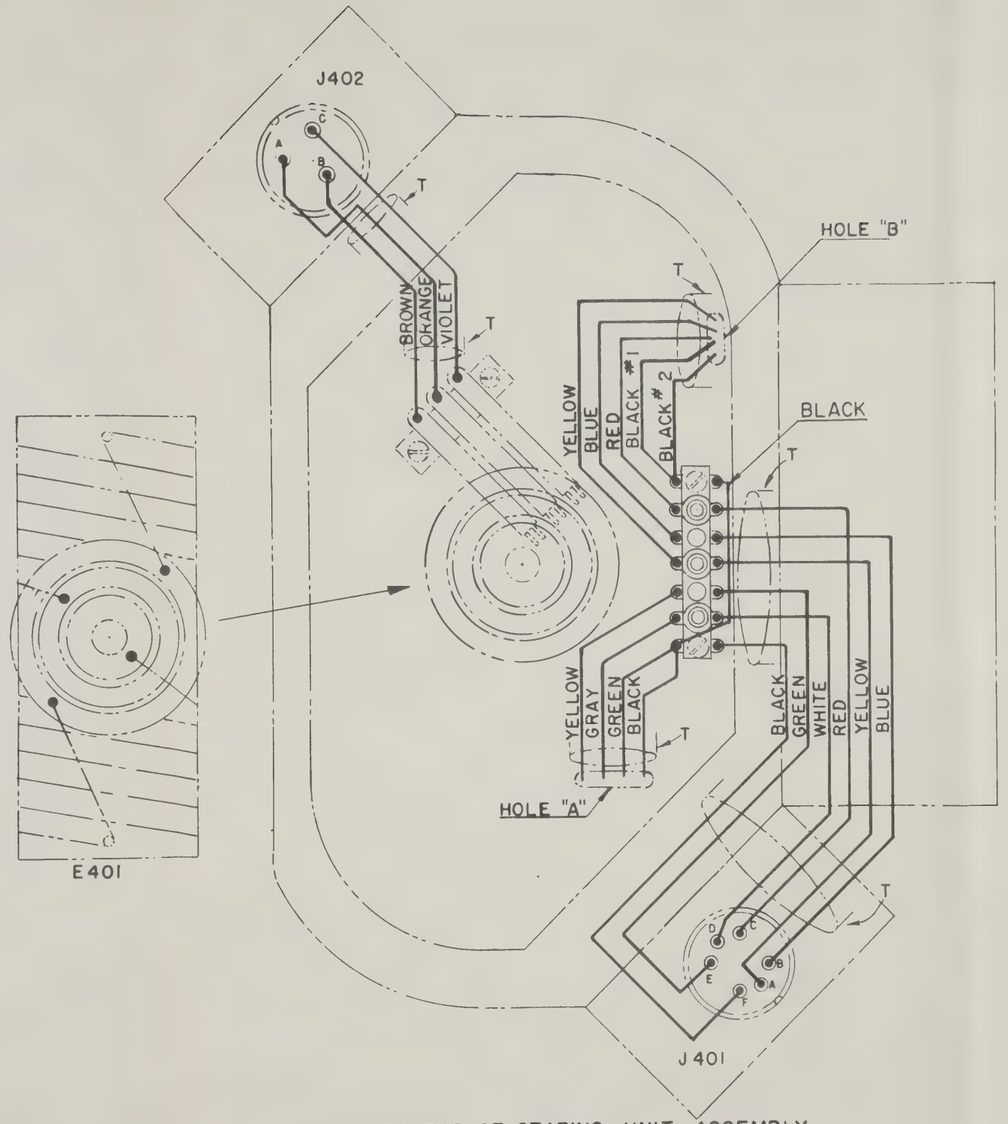
WIRING TO BOTTOM OF GEARING UNIT ASSEMBLY

Figure 6–13. Loop Type L-11, Wiring Diagram

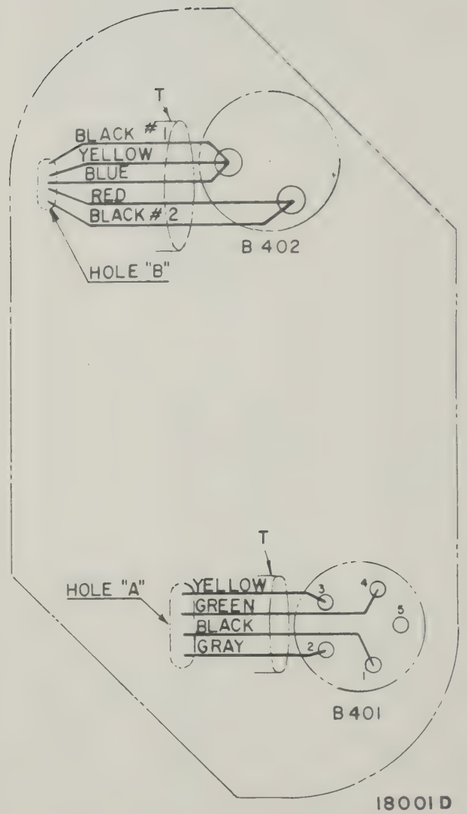
NOTES:

1. INSTALL PLASTIC COATED FIBERGLAS TUBING OVER WIRES MARKED "T."
2. FOR SCHEMATIC DIAGRAM SEE FIGURE 6-12.
3. WIRES FROM B401 AND B402 ARE MOTOR LEADS AND ARE FURNISHED AS PART OF THE MOTOR.
4. ALL WIRES ARE #24 STRANDED COPPER, TEFLON INSULATED, UNLESS OTHERWISE SPECIFIED.

SYMBOL IDENTIFICATION TABLE		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
B401	18007	MOTOR, INDUCTION
B402	18008	SYNCHRO, TRANSMITTER
E401	17998	LOOP SUB-ASSEMBLY
J401	18017	RECEPTACLE ASSEMBLY
J402	18016	RECEPTACLE ASSEMBLY

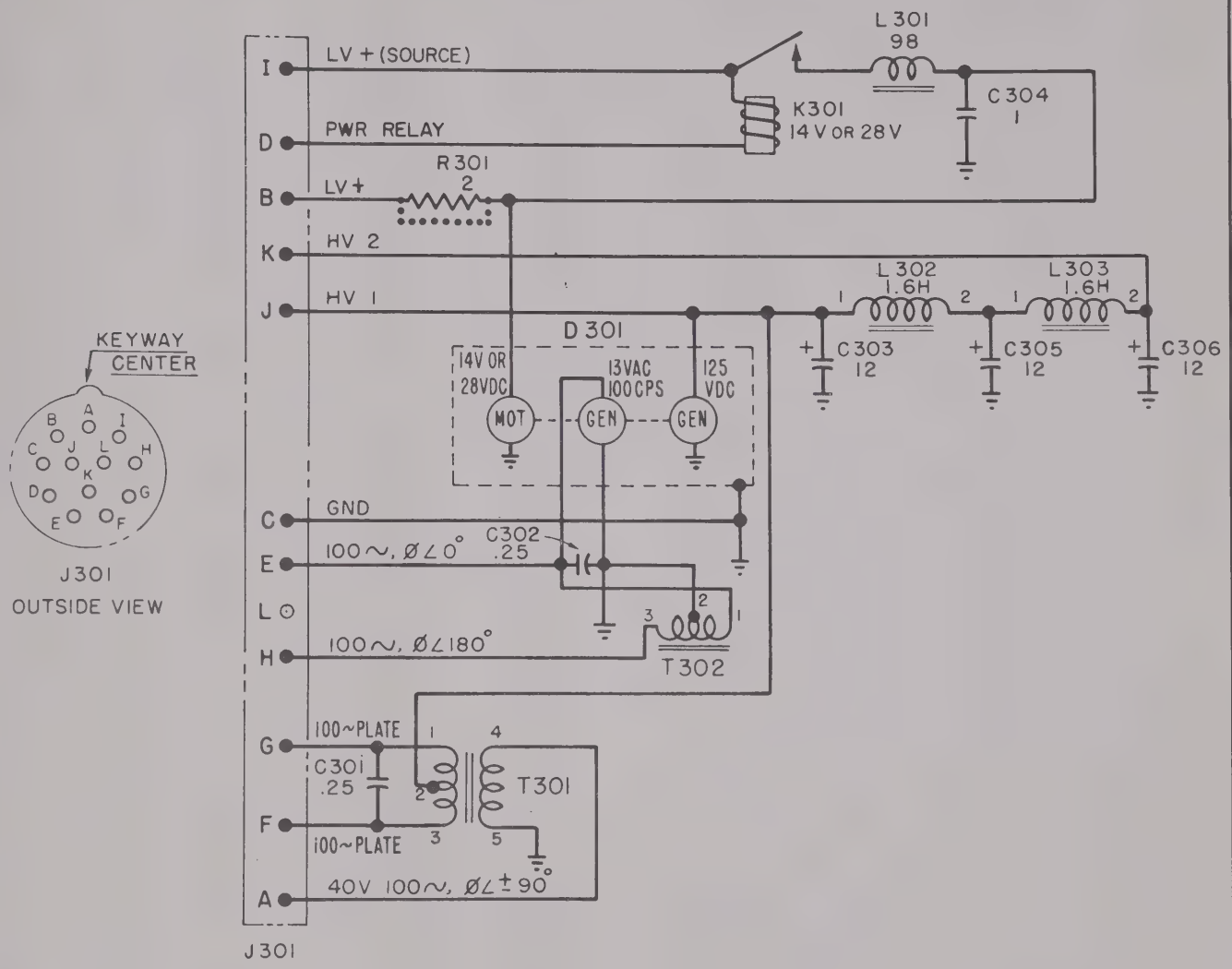


WIRING TO TOP OF GEARING UNIT ASSEMBLY



WIRING TO BOTTOM OF GEARING UNIT ASSEMBLY

Figure 6—13. Loop Type L-11, Wiring Diagram



NOTES:

1. FOR WIRING DIAGRAM SEE FIGURE 6-15.
2. FOR 14-VOLT OPERATION REMOVE R301 AND REPLACE WITH WIRE MARKED •••••••.
3. RESISTANCE VALUE IS IN OHMS.
4. CAPACITOR VALUES ARE IN MICROFARADS (µF).
5. INDUCTOR VALUES ARE IN MICROHENRIES (µH), UNLESS OTHERWISE SPECIFIED.
6. RELAY IS IN UNENERGIZED POSITION.

18022 C

Figure 6—14. Power Unit Type P-14, Schematic Diagram

NOTES:

1. FOR 14-VOLT
2. FOR SCHEMA
3. ALL WIRES M
4. ALL UNMARK
5. COVER WIRES

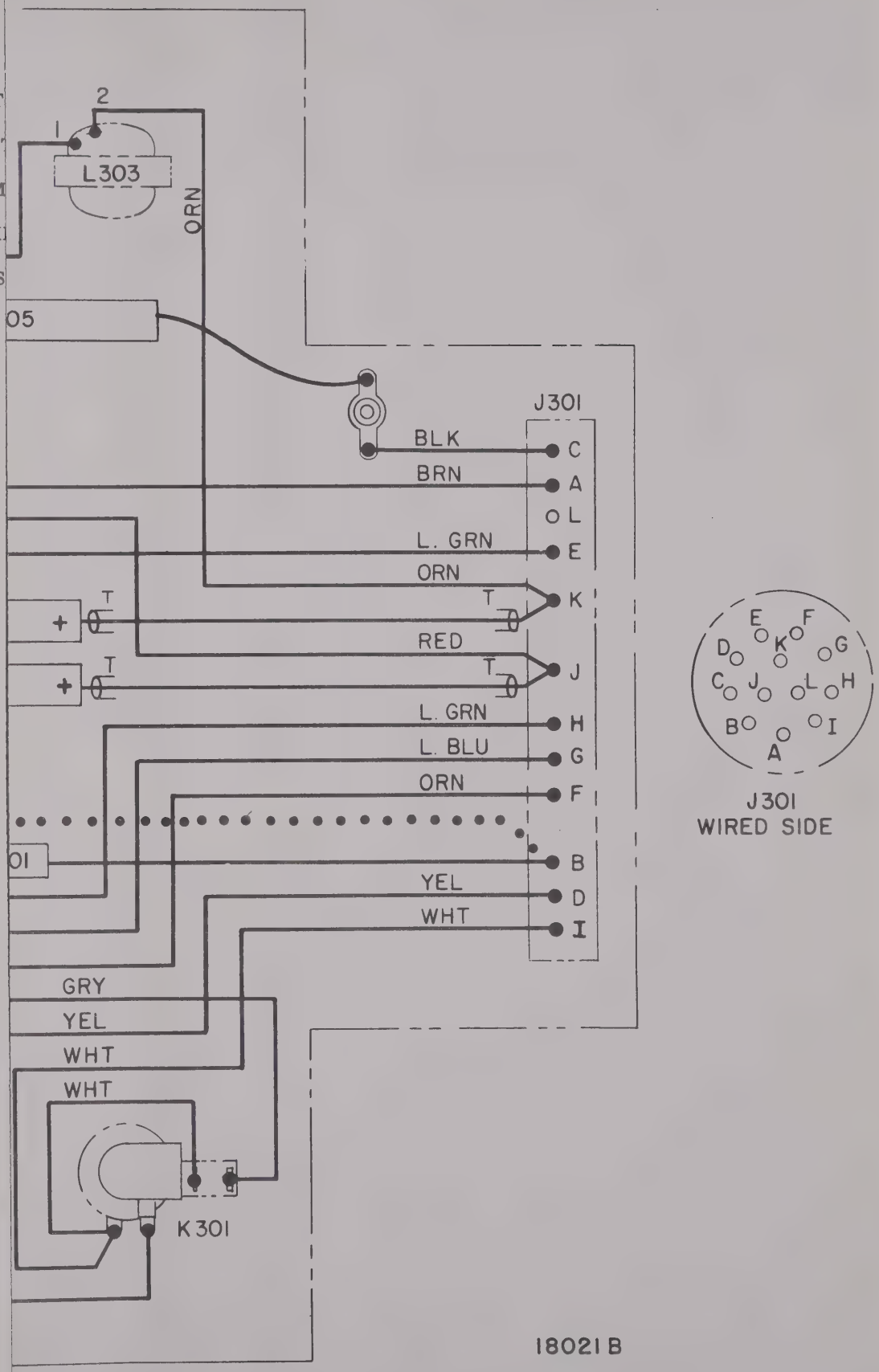


Figure 6—15. Power Unit Type P-14, Wiring Diagram

NOTES:

1. FOR 14-VOLT OPERATION REMOVE R301 AND REPLACE WITH WIRE MARKED ·····.
2. FOR SCHEMATIC DIAGRAM SEE FIGURE 6-14.
3. ALL WIRES MARKED WITH COLOR NOTE ARE #22 SOLID COPPER.
4. ALL UNMARKED WIRES ARE #22 SOLID TINNED COPPER.
5. COVER WIRES MARKED "T" WITH TRANSPARENT VINYLITE TUBING OF APPROPRIATE SIZE.

SYMBOL IDENTIFICATION TABLE		
SYMBOL NO.	DRAWING NO.	DESCRIPTION
C301	15763	.25 uF
C302	12709	.25 uF
C303	8777	12 uF
C304	16653	1 uF
C305	8777	12 uF
C306	8777	12 uF
D301	18334	14V DYNAMOTOR
	18335	28V DYNAMOTOR
J301	16713	RECEPTACLE
K301	14484	14V RELAY
	14485	28V RELAY
L301	5546	98 uH
L302	18328	1.5 uH
L303	18328	1.5 uH
R301	8778	2 OHMS
T301	18329	TRANSFORMER
T302	18053	TRANSFORMER

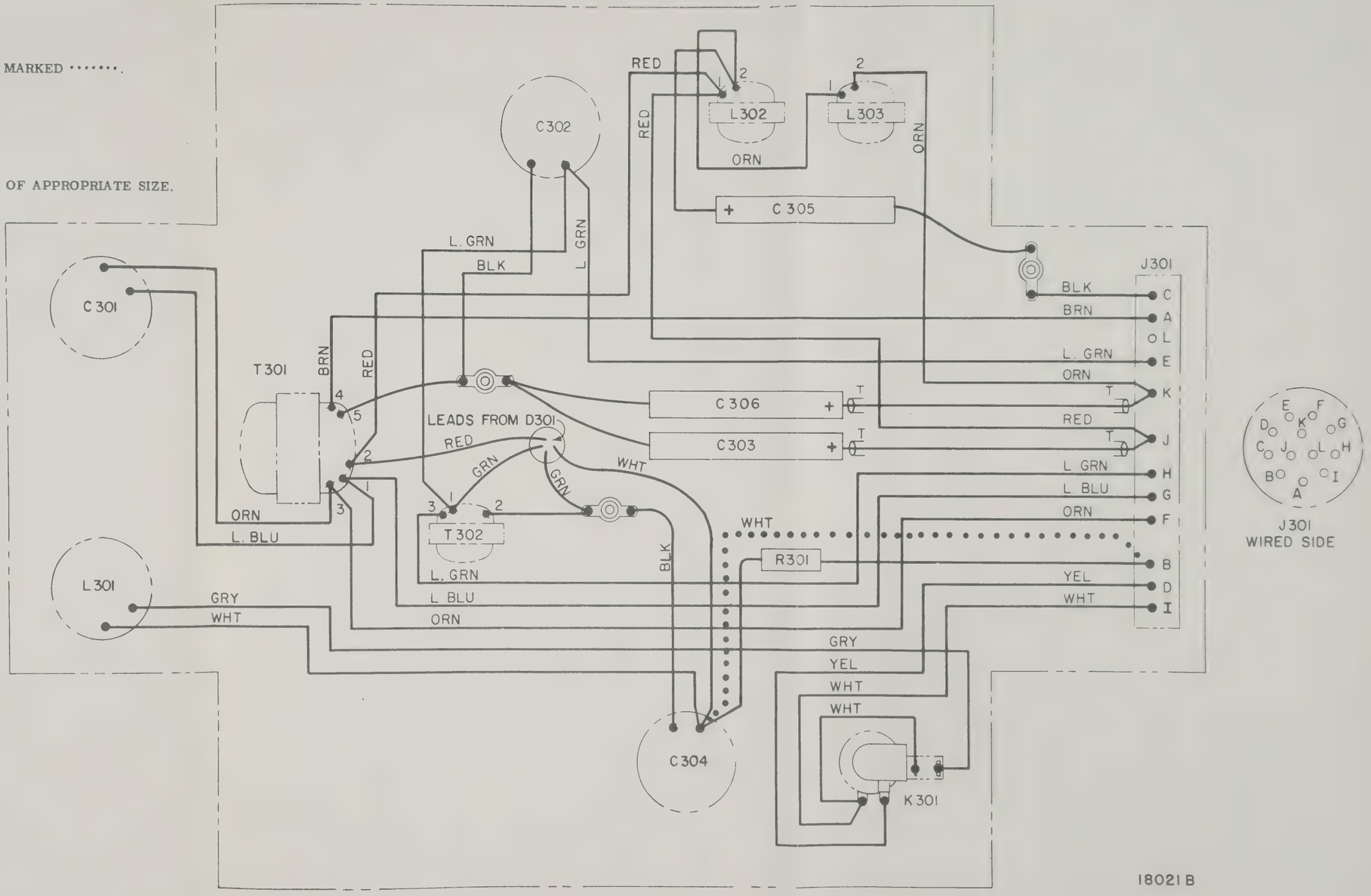


Figure 6–15. Power Unit Type P-14, Wiring Diagram

NOTES:

1. DIAGRAM IS FOR A SINGLE

2. CONNECTIONS ARE SHOWN
   IF OTHER MOUNTINGS ARE

   A. TOP LOOP -
      BELLY ANTENNA
   B. BELLY LOOP -
      TOP ANTENNA
   C. TOP LOOP -
      TOP ANTENNA

3. A SECOND IN-12 MAY BE P

4. IN CONTROL UNIT C-59, SP
   INTERNALLY, AND IF DESI
   SHOWN FOR THE 13V 100~

5. ALL WIRES ARE #20 EXCEP

6. FOR ASSOCIATED CABLING

NOTES:

1. DIAGRAM IS FOR A SINGLE ADF INSTALLATION. FOR DUAL INSTALLATION SEE FIGURE 6-18.

2. CONNECTIONS ARE SHOWN FOR THE CASE OF BELLY-MOUNTED LOOP AND SENSE ANTENNA. IF OTHER MOUNTINGS ARE EMPLOYED, INTERCHANGE LEADS AS FOLLOWS:

	AT POWER UNIT	AT CONTROL UNIT	AT INDICATOR
A. TOP LOOP - BELLY ANTENNA	F & G	–	B & C
B. BELLY LOOP - TOP ANTENNA	F & G	M & L	–
C. TOP LOOP - TOP ANTENNA	–	M & L	B & C

3. A SECOND IN-12 MAY BE PARALLELED WITH THE INDICATOR SHOWN IF DESIRED.

4. IN CONTROL UNIT C-59, SPARE TERMINALS A, B, C, AND D ARE STRAPPED TOGETHER INTERNALLY, AND IF DESIRED MAY BE USED IN PLACE OF THE JUNCTION BOX TERMINALS SHOWN FOR THE 13V 100~ ∠0° LEADS.

5. ALL WIRES ARE #20 EXCEPT THOSE MARKED WITH AN ASTERISK (*), WHICH ARE #16.

6. FOR ASSOCIATED CABLING DIAGRAM SEE FIGURE 6-17.

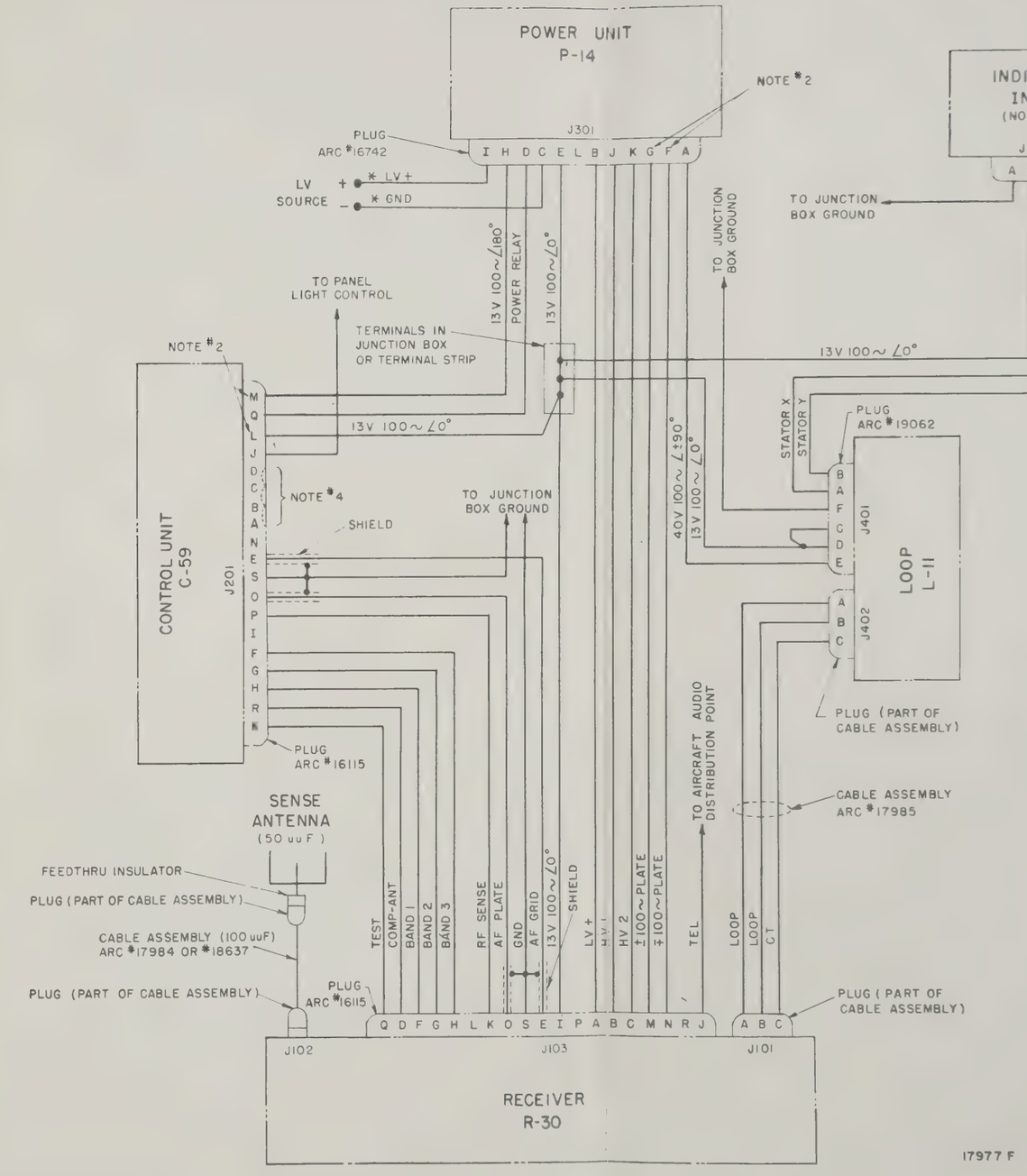


Figure 6–16. ARC Type 21 ADF, Single ADF Installation, External Connection Diagram

UG
491

TO
GROUND

NOTES:

1. FOR EXTERNAL CONNECTION DIAGRA
2. RIGHT-ANGLE COUPLING, ARC-6357, MECHANICAL LINKAGE, DEPENDING
3. A SECOND IN-12 MAY BE PARALLELE
4. USE GROUND STRAPS OF M-26 AND M RESPECTIVELY.
5. SENSE ANTENNA AND FEED-THROUGH ANTENNA KIT ARC-19210, WHICH IS A FEED-THROUGH INSULATOR ARC-1907
6. MECHANICAL LINKAGE ARC-16158 AN ARC TYPE 21 ADF.

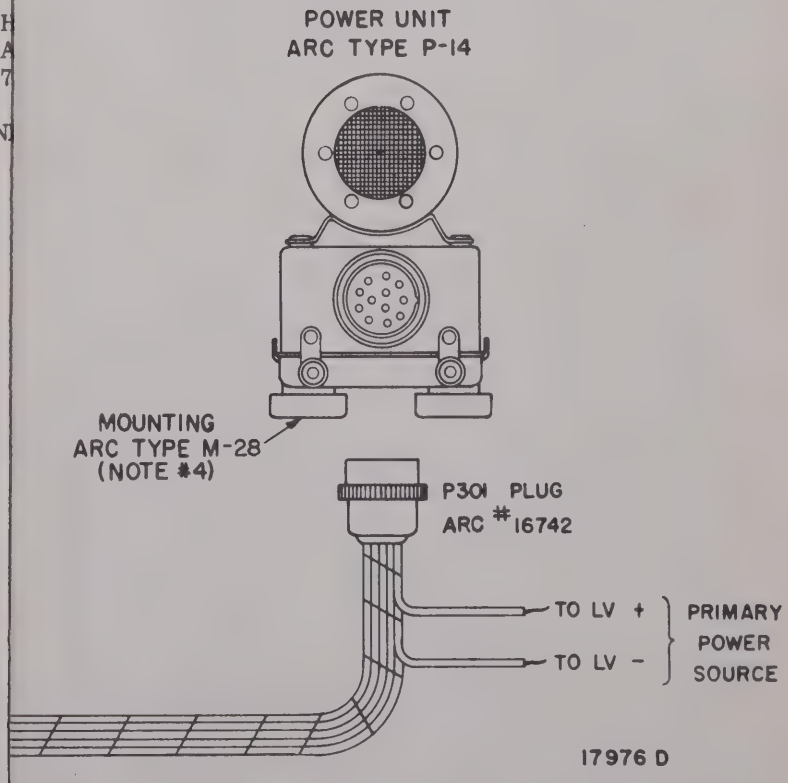


Figure 6—17. ARC Type 21 ADF, Single ADF Installation, Cabling Diagram

NOTES:

1. FOR EXTERNAL CONNECTION DIAGRAM SEE FIGURE 6-16.
2. RIGHT-ANGLE COUPLING, ARC-6357, MAY BE REQUIRED AT EITHER OR BOTH ENDS OF MECHANICAL LINKAGE, DEPENDING UPON INSTALLATION.
3. A SECOND IN-12 MAY BE PARALLELED WITH THE INDICATOR SHOWN, IF DESIRED.
4. USE GROUND STRAPS OF M-26 AND M-28 MOUNTINGS TO GROUND R-30 AND P-14, RESPECTIVELY.
5. SENSE ANTENNA AND FEED-THROUGH INSULATOR ARE SUPPLIED AS PART OF SENSE ANTENNA KIT ARC-19210, WHICH IS AN OPTIONAL PART OF ARC TYPE 21 ADF; HOWEVER, FEED-THROUGH INSULATOR ARC-19077 MAY BE SUPPLIED AS A SEPARATE PART.
6. MECHANICAL LINKAGE ARC-16158 AND OPEN-WIRE CABLE NOT SUPPLIED AS PART OF ARC TYPE 21 ADF.

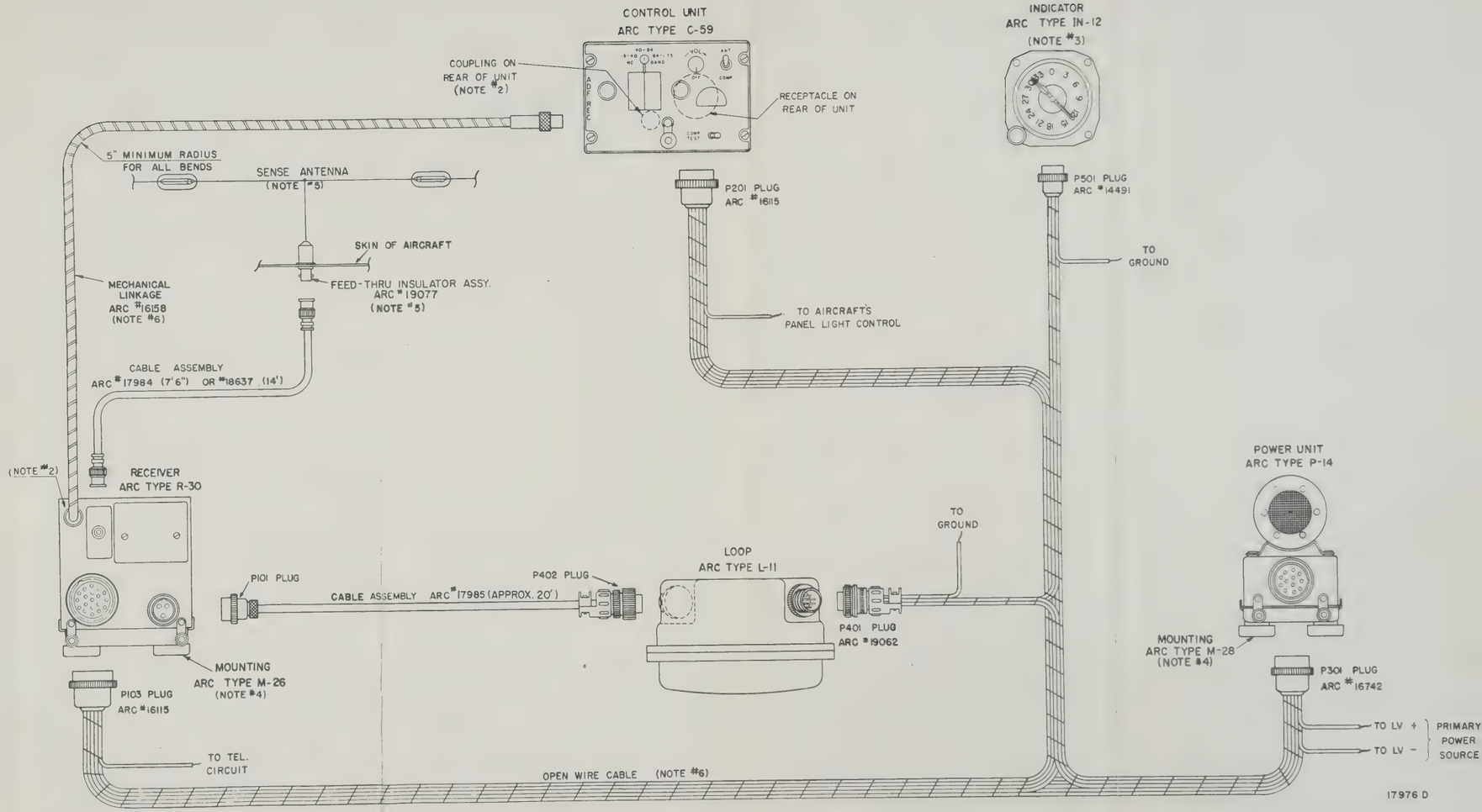


Figure 6—17. ARC Type 21 ADF, Single ADF Installation, Cabling Diagram

NOTES:

1. FOR SINGLE INSTALLATION SEE FIGURE 6-16.
2. CONNECTIONS FOR EACH ADF SYSTEM ARE SHOWN FOR THE CASE OF BELLY-MOUNTED LOOP AND SENSE ANTENNA. IF OTHER MOUNTINGS ARE EMPLOYED, INTERCHANGE LEADS IN THE PARTICULAR SYSTEM AS FOLLOWS:

	AT POWER UNITS	AT CONTROL UNITS	AT INDICATOR
A. TOP LOOP - BELLY ANTENNA	F & G	–	B & C (SYSTEM #1) OR E & F (SYSTEM #2)
B. BELLY LOOP - TOP ANTENNA	F & G	M & L	–
C. TOP LOOP - TOP ANTENNA	–	M & L	B & C (SYSTEM #1) OR E & F (SYSTEM #2)

3. A SECOND IN-13 MAY BE PARALLELED WITH THE INDICATOR SHOWN IF DESIRED.
4. IN THE CONTROL UNITS C-59, SPARE TERMINALS A, B, C, AND D ARE STRAPPED TOGETHER, AND IF DESIRED MAY BE USED IN PLACE OF THE JUNCTION BOX TERMINALS SHOWN FOR THE 13V 100~ ∠0° LEADS.
5. ALL WIRES ARE #20 EXCEPT THOSE MARKED WITH AN ASTERISK (*), WHICH ARE #16.
6. FOR CABLING DIAGRAM SEE FIGURE 6-19.

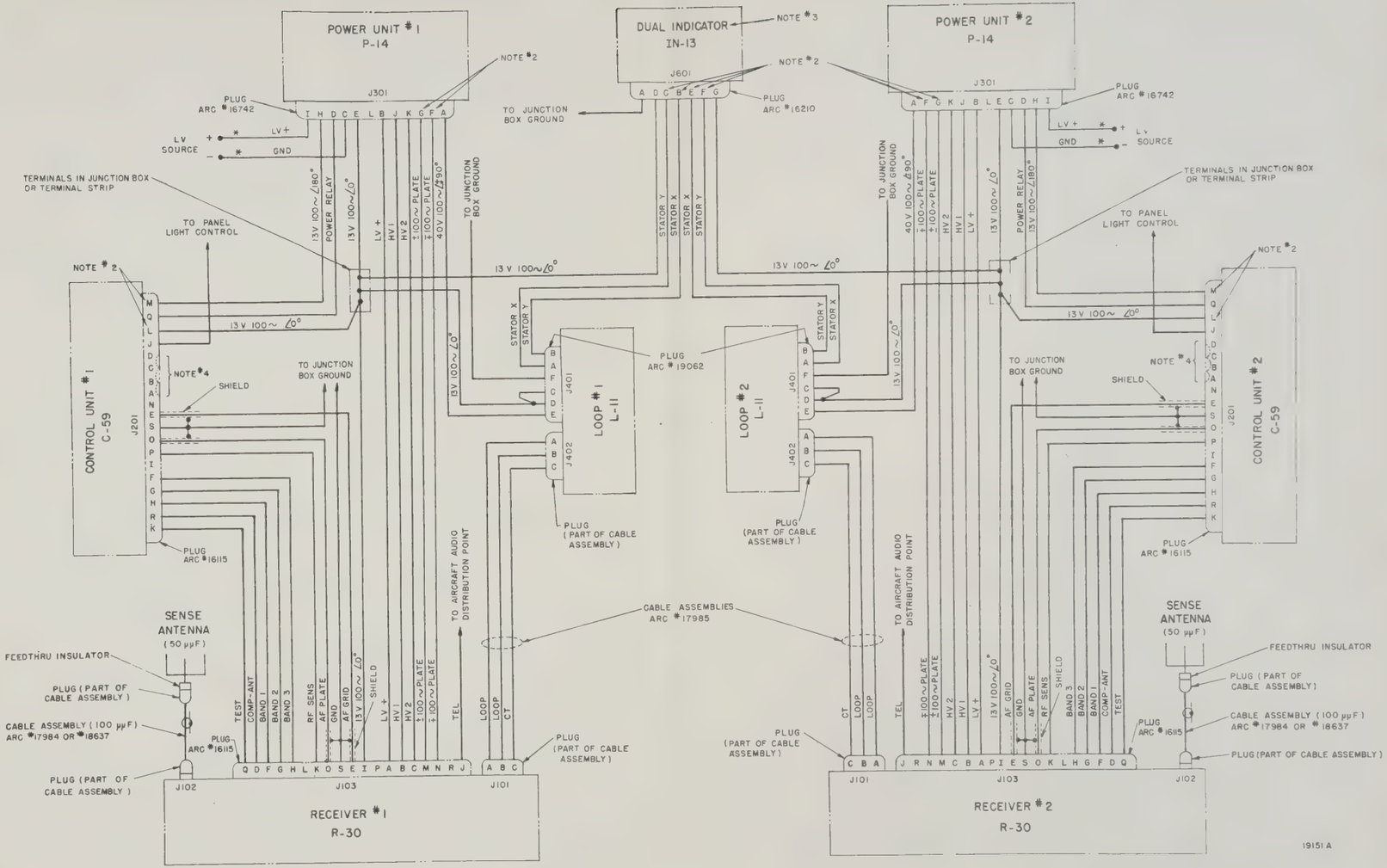


Figure 6–18. ARC Type 21 ADF, Dual ADF Installation, External Connection Diagram

NOTES:

1. FOR EXTERNAL CONNECTION DIAGRAM SEE FIGURE 6-18.
2. RIGHT-ANGLE COUPLING ARC-6357 MAY BE REQUIRED AT EITHER END OR BOTH ENDS OF MECHANICAL LINKAGES, DEPENDING UPON INSTALLATION.
3. A SECOND IN-13 MAY BE PARALLELED WITH THE INDICATOR SHOWN IF DESIRED.
4. USE GROUND STRAPS OF M-26 AND M-28 MOUNTINGS TO GROUND R-30 AND P-14, RESPECTIVELY.
5. SENSE ANTENNA AND FEED-THROUGH INSULATOR ARE SUPPLIED AS PART OF SENSE ANTENNA KIT ARC-19210, WHICH IS AN OPTIONAL PART OF ARC TYPE 21 ADF; HOWEVER, FEED-THROUGH INSULATOR ARC-19077 MAY BE SUPPLIED AS A SEPARATE PART.
6. MECHANICAL LINKAGE ARC-16158 AND OPEN-WIRE CABLE NOT SUPPLIED AS PART OF ARC TYPE 21 ADF.

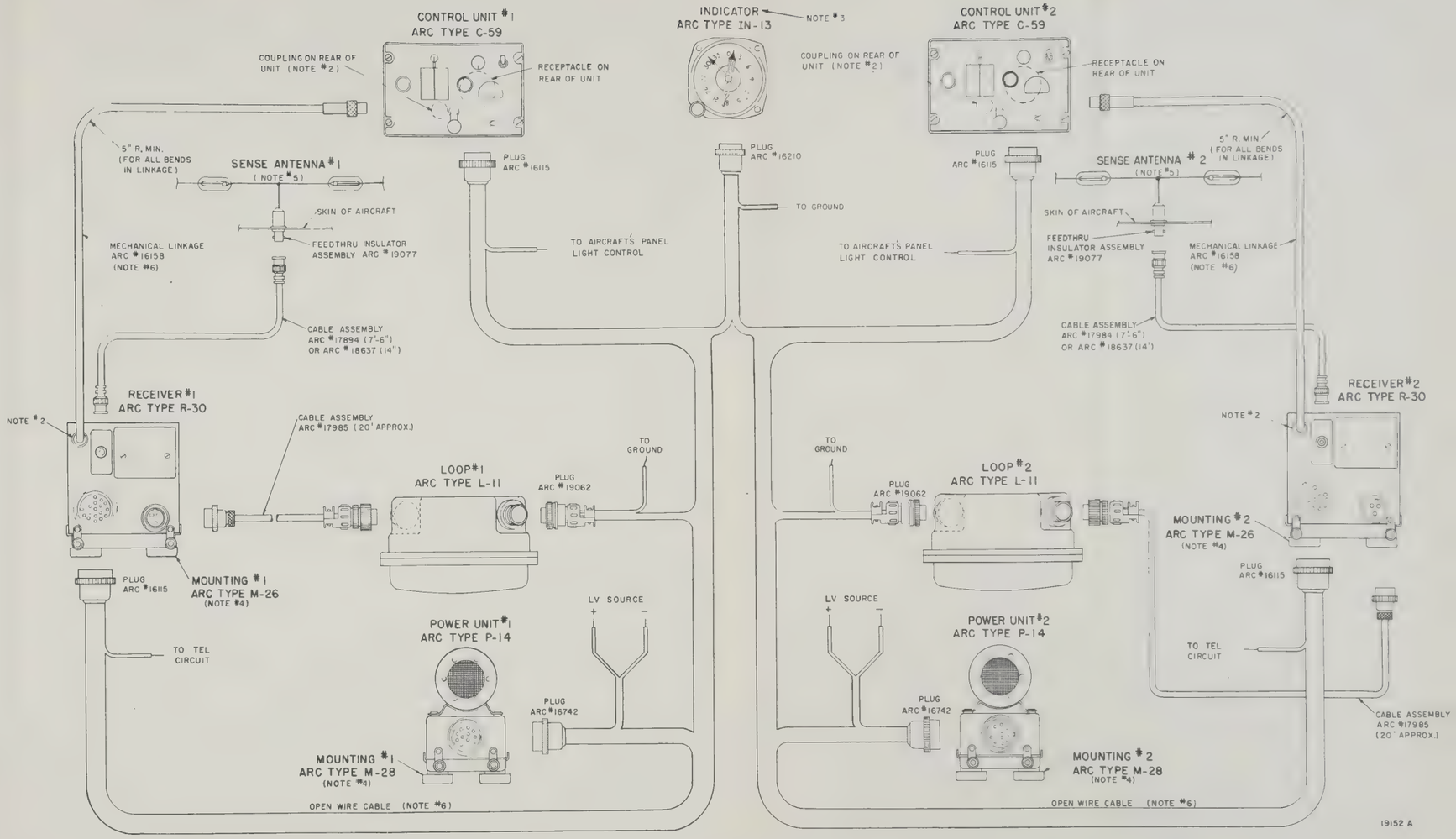


Figure 6–19. ARC Type 21 ADF, Dual ADF Installation, Cabling Diagram

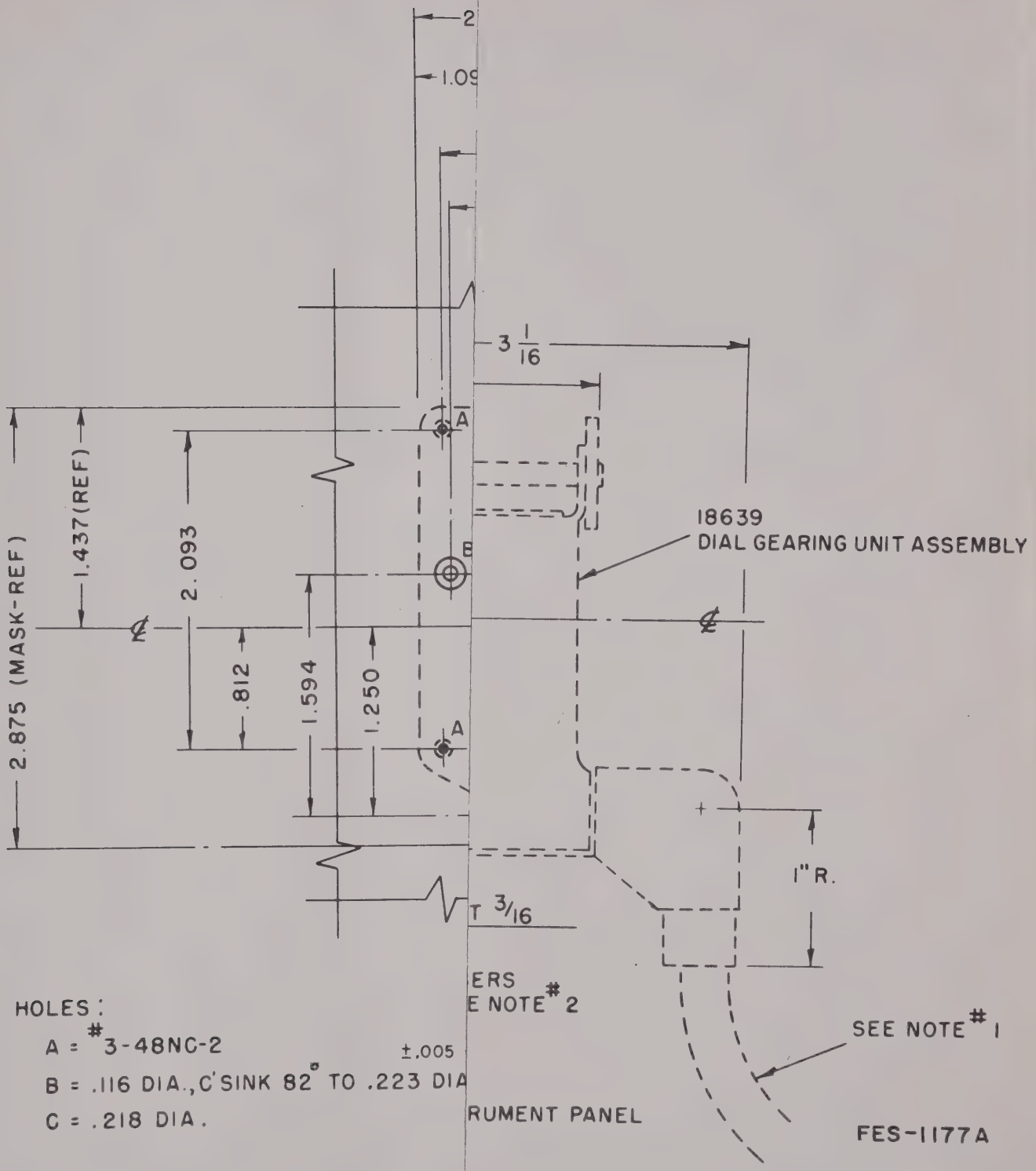
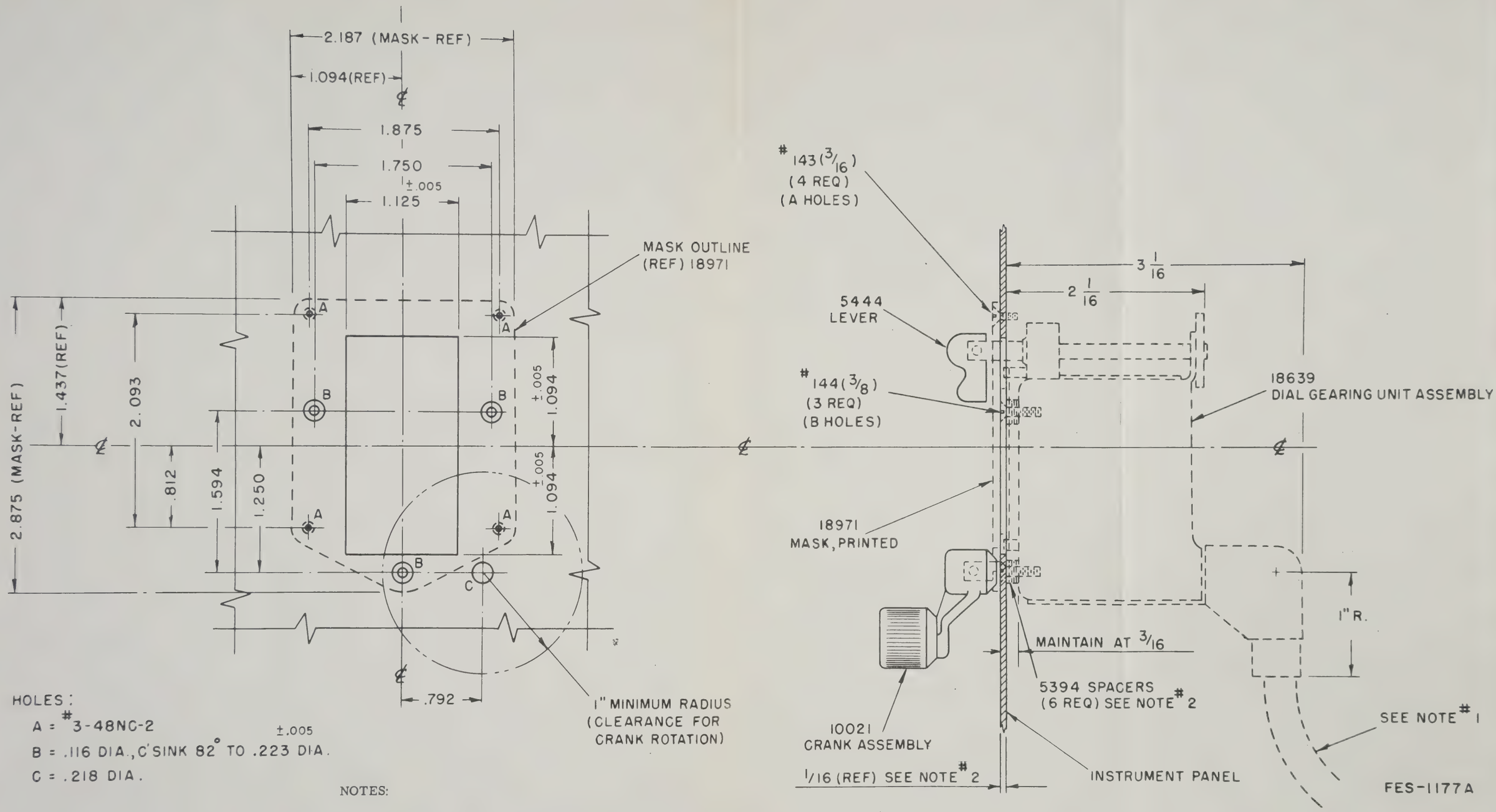


Figure 6—20. Panel Mounting Dimensions for Installation of Dial Gearing Unit and Mask in Custom Control Panel



NOTES:

1. ALLOW 5 INCH MINIMUM BEND RADIUS FOR MECHANICAL LINKAGE.
2. FOR PANELS THICKER THAN 1/16, DECREASE QUANTITY OF SPACERS (5394) AS REQUIRED.

Figure 6—20. Panel Mounting Dimensions for Installation of Dial Gearing Unit and Mask in Custom Control Panel

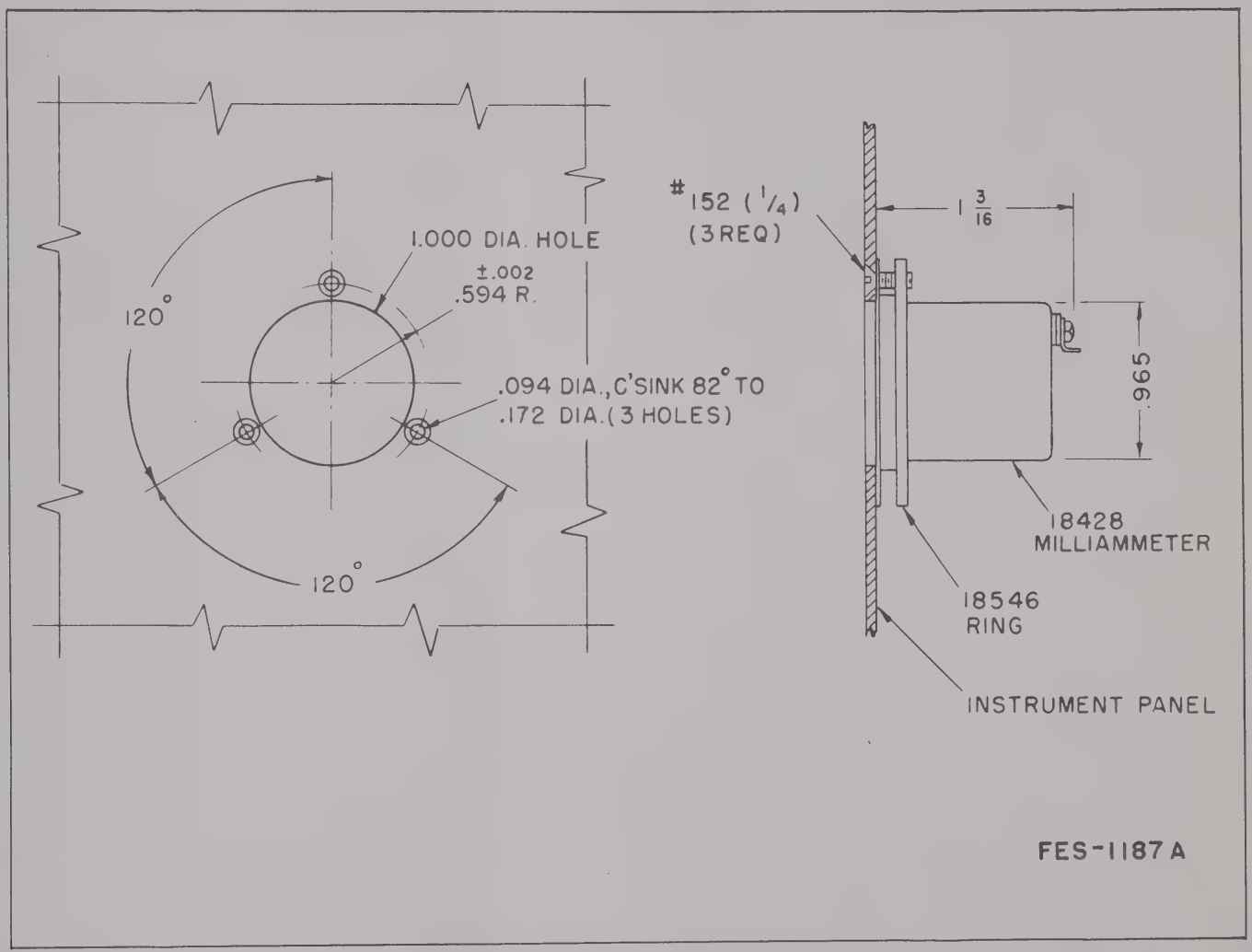


Figure 6–21. Panel Mounting Dimensions for Installation of Tuning Meter in Custom Control Panel

LOOP COMPENSATION DATA CURVE

Date _____ By _____

Aircraft Type and No. _____

Station _____ Frequency _____

Ground Reference Line _____

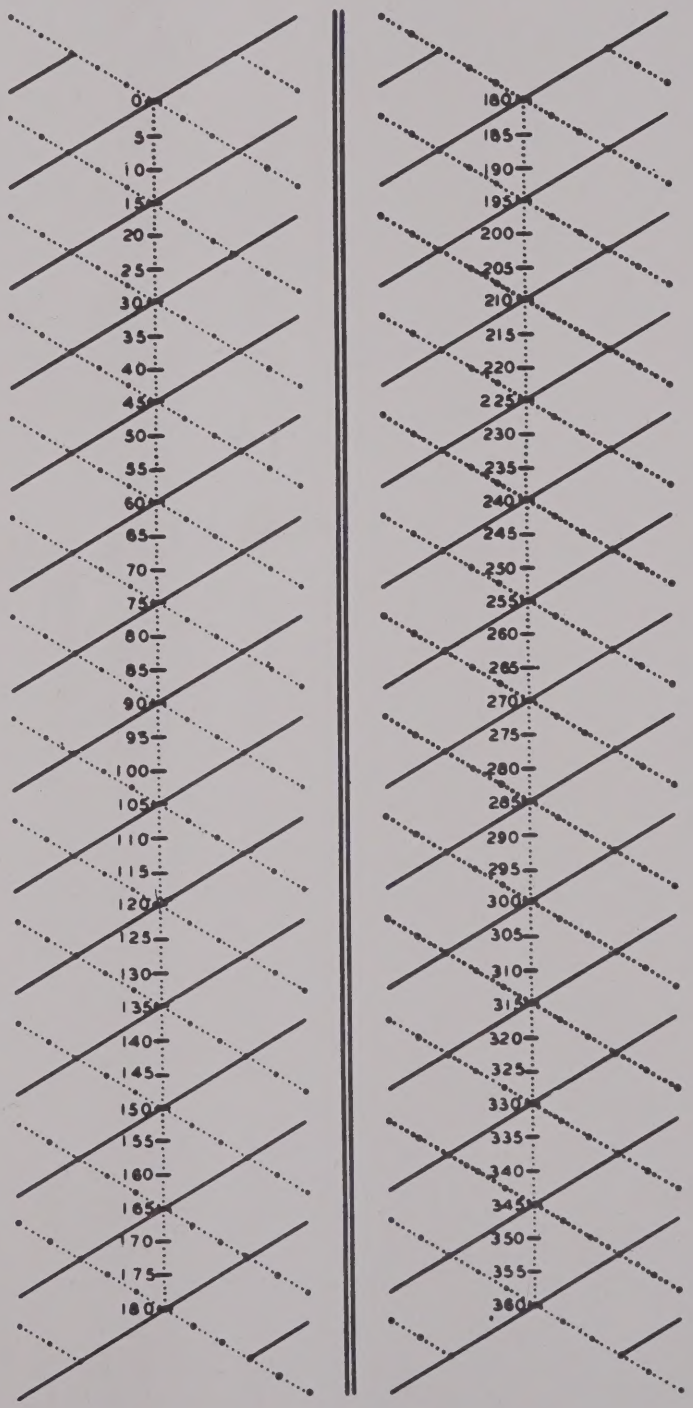


Figure 6—22. Form for Plotting Loop Compensation Data Curve (Spare)

(THIS PAGE IS PERFORATED TO PERMIT REMOVAL.)

Aircraft Radio Corporation

Dependable Airborne Electronic Equipment Since 1928

Printed in U. S. A.